Comprehensive Fisheries Evaluation of Patten Lake, Florence County, Wisconsin 2011

Water body Identification Code 0653700

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Florence

February, 2012

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Lake and location:
Patten Lake, Florence County, T.39N. R.17E. Sec. 18-19
Located in central Florence County, about 10 miles southwest of Florence. Patten Lake is part of the Menominee River watershed and is drained by Woods Creek.

Physical/Chemical attributes:
Morphometry: 255 acres, maximum depth 52 feet.
Lake type: Drainage (two inlets, one outlet to Woods Creek).
Basic water chemistry: Medium hard – alkalinity 72 mg/l, conductance 156 µmhos.
Water clarity: Slightly stained, secchi disc reading of 8.5' (August 2011)
Littoral substrate: 59% gravel, 26% sand and 15% muck.
Aquatic vegetation: Moderately abundant
Shoreline character: 75% upland, 25% wetland
Level of shoreline development: Moderate
Winterkill: None reported or likely.
Boat landing: Concrete-plank ramp with parking for five vehicles with trailers.
Other features: *Orconectes rusticus* (Rusty) crayfish present

Purpose of Survey: Comprehensive fisheries survey; regulation evaluation.

Dates of fieldwork:
Walleye / northern pike netting, April 25-28 2011.
Panfish netting, June 17 & June 20, 2011.
Black bullhead removal / northern pike recapture netting, June 15-July 1, 2011
Electrofishing (entire shoreline) April 28, May 18 & 24, June 1 & 2 and October 1, 2011.

ACKNOWLEDGEMENTS

Brad Shucha, Dave Wittlinger, Nick Neuens, Jim LaChapell, Derrick Raspor, Mari Dallapiazza, Mick Mlinan, and Aaron Presterl assisted in the field. Brad Shucha assigned game and panfish age from scales. Russ Cassens allowed the usage of his waterfront for boat storage and spear-headed the volunteer group that removed young-of-the-year bullheads from Patten Lake during the summer of 2011. The Patten Lake Association was very interested and supportive in survey and management efforts on the lake.

I. EXECUTIVE SUMMARY

Patten Lake was surveyed during 2011 with a variety of sampling gear to assess the status of the fishery. Sampling began with early spring fyke netting and electrofishing for adult gamefish, a summer fyke netting assessment of the panfish population as well as a bullhead removal project followed, and the survey concluded with a fall electrofishing survey to assess gamefish recruitment.

Five naturally reproducing gamefish species were captured during our survey of Patten Lake. Northern pike are the most abundant gamefish species (6.53 adults/acre), followed by largemouth bass (1.13 adults/acre), walleye (0.97 adults/acre) and smallmouth bass (0.90 adults/acre). Northern pike have surprisingly good size structure (26% $\geq$ 24.0 inches) and growth in relation to their abundance. The walleye population has dropped drastically since its peak measurement in 1993; this can be attributed to the liberalization of regulations, decreased recruitment, and a changing fish community. Walleye size structure is exceptional, but not sustainable, with over 85% of fish sampled during spring surveys being $\geq$ 15.0 inches and over 6% $\geq$ 28.0 inches in total length. Largemouth and smallmouth bass have relatively small populations that exhibit excellent size structure and growth. A small number of brook trout were sampled during spring fyke netting, these fish most likely utilize the lake during certain times of the year and migrate in from nearby Woods Creek via Patten Lake Outlet.

Seven panfish species were captured during the 2011 survey. Bluegill are the most abundant panfish species and the only species that is abundant enough to offer quality angling opportunities. Black bullheads were at a higher relative abundance than bluegill at the start of the survey. However, since this population had reached nuisance levels that may be impacting other fish species they were removed throughout the 2011 survey. Black bullheads are now the second most abundant panfish species in Patten Lake. The five other panfish species in order of abundance are as follows; rock bass, pumpkinseed, yellow perch, black crappie and bluegill x pumpkinseed hybrid. Bluegill and black crappie have good size structure, while other panfish species have poor size structure.

Three non-game species were also captured during our survey work. These species in order of abundance were white sucker, golden shiner and creek chub. Of these three species only white sucker appear to have a significant population.

II. PAST MANAGEMENT AND SURVEYS

Known Stocking History:

Largemouth Bass	– fingerlings, 6 of 16 years from 1937-1953, 1995 and 1997
Northern Pike	- fingerlings, 1998
Rainbow Trout	- fingerlings, 1956
Smallmouth Bass	- fingerlings, 1941-42
Walleye	- fingerlings, 1974, 1976, and 1978

Past Management Activities:

- 1966 - Public access established.
- July, 1966 (Burdick) - Water temperature and dissolve oxygen profile showed that most of the deeper, cooler waters were devoid of dissolved oxygen in midsummer.
- August 7-11, 1967 (McKnight and Theis) - Summer fyke net survey found a fair abundance of largemouth bass, which were the only predatory gamefish present in the lake. Large numbers of "average sized" panfish (rock bass, bluegills, pumpkinseeds and yellow perch) were captured. An abundance of white suckers were also noted. Spawning habitat analysis suggested that the lake had "good" habitat for smallmouth bass and walleye as well as "fair to good" habitat for muskellunge and northern pike. Muskellunge stocking was recommended to introduce another predator species to take advantage of the abundant white sucker and yellow perch population. Residents protested the planned muskellunge introduction and requested walleyes.
- July 30-August 2, 1974 (Burdick) - Fyke nets were used to asses the game and panfish populations. The status of the bass and panfish populations remained "unchanged". A good catch of brook trout near the inlet suggested there to be a "limited" cold water fishery.
- August, 1974 - 25,000 walleye fingerlings were introduced to Patten Lake.
- August 15, 1977 (Burdick) – A single night electrofishing survey covering ¾ of Patten Lake showed a good bass population and suggested moderate survival of stocked walleyes.
- April 9-17, 1981 (Thuemler) - Fyke nets were used to determine the success of the walleye stockings and to determine if natural reproduction of walleye was beginning to occur. The walleye population had grown to 3.8 adults per acre, exhibiting growth rates "considerably better than the average for northeastern Wisconsin". Natural reproduction did occur in 1979 and possibly in 1977. A boom shocker survey during fall 1981 also confirmed that walleye reproduction took place in 1980 and 1981. A good largemouth bass population exists in Patten Lake, with average growth for NE Wisconsin. Patten Lake has an "excellent" pan fish population with yellow perch being most abundant followed by bluegills. There is an abundant white sucker population that does not appear to be harming either the game or panfish in the lake.
- April 29-Sept 14, 1993 (Heizer) - A comprehensive fisheries evaluation was done using fyke nets and electrofishing surveys. A naturally reproducing walleye population estimated between 6.9 and 9.4 adults per acre showing poor walleye size structure and growth rates, most likely a result of increased competition. However, three fish were captured between 30 and 32.8 inches. Largemouth bass were present at a low density, displaying great size structure. Recruitment of largemouth bass is significantly below that found in 1981. Rock bass, bluegill and yellow perch dominate the pan fish population, which shows average to above average growth rates. Black bullheads were found to be the most predominant forage species (135.5 per net lift). No stocking of any fish species is needed to maintain the fishery.
- May–October, 1993 - Creel survey analysis along with voluntary tag return. Walleyes were the most sought after fish species. The current level of fishing pressure was estimated at 29.31 hours/acre.

- 1997 - Walleye regulation change from 15-inch MSL to no minimum size limit, with only one fish being over 14 inches, 3 bag.
- June, 1998 - 1,050 northern pike fingerlings were introduced to Patten lake.
- April, 2000 - Fyke nets and electrofishing were used to estimate the adult walleye population at 2.5 adults per acre. Size structure of walleyes had increased since 1993.
- May, 2001 – March, 2002 - Creel Survey analysis. The total amount of time spent fishing on Patten Lake has declined since 1993, currently estimated at 26.33 hours/acre.
- April 21–Sept. 23, 2004 (Young) - Comprehensive fisheries survey using a variety of sampling gear to assess the status of gamefish (primarily walleye). The walleye population, estimated at 2.3 adults per acre, had "exceptional" size structure. It was determined that the walleye regulation (no minimum, w/ 1 fish over 14 inches, bag of 3) appears to be appropriate, but should be re-assessed within 5 years. Patten Lake had a moderate-sized, naturally reproducing northern pike population (estimated at 2.1 adults/acre) which was created by the 1998 stocking. Largemouth and smallmouth bass populations were not estimated but appear to be less abundant than walleye and northern pike. Black bullheads were relatively more abundant than any other panfish species, followed by bluegill, yellow perch, rock bass and black crappie.
- May, 2004 – March, 2005 - Creel survey analysis. Walleyes were most sought after fish species, followed by bluegill. The total amount of time spent fishing on Patten Lake has declined steadily since 1993, estimated at 22.49 hours/acre. Walleye catch rates have declined, but the harvest rate is higher under the more liberal regulation.
- 1991 – 2010 – Fall recruitment surveys were conducted 12 of 20 years to assess walleye reproduction.

III. METHODS

The survey began on 4/24/2011 when eight standard fyke nets (3/4" stretch mesh) were set in Patten Lake to sample adult gamefish. On 4/26, three nets were removed from the lake, leaving five nets, which were fished for two more days. A WDNR standard, alternating current, electrofishing boat was used to recapture walleyes on the evening of 4/28. Four more electrofishing surveys were conducted to sample northern pike, smallmouth and largemouth bass between 5/18 and 6/2. Eleven standard fyke nets were set on 6/14 to initiate a bullhead removal project. Four more nets were set the next day (6/15), these 15 nets would be fished until 6/24 when we reduced the number of nets to 12, and these nets were fished until 6/29 when one more net was removed. The remaining 11 nets were fished until 7/1 and then all nets were removed from Patten Lake. During the bullhead removal project panfish were sampled on 6/17 and 6/20 to analyze the relative abundance, size structure and growth of panfish populations. The survey culminated with an electrofishing survey on 10/1/2011 to assess gamefish recruitment.

During the survey, length or length category (nearest half-inch), was recorded for all gamefish and for panfish (6/17 & 6/20). Adult walleye were given bottom caudal fin clips while all other adult game fish were given a left pelvic fin clip and juveniles were given a top caudal fin clip for use in mark-recapture population estimates. Age structures were removed and weights were measured from five gamefish and panfish for each species, sex and half-inch group.

IV. RESULTS AND DISCUSSION

Catch Summary

Five gamefish, 7 panfish and 3 non-game fish species were captured during the 2011 survey of Patten Lake (Figure 1 & Table 6, Appendix C).

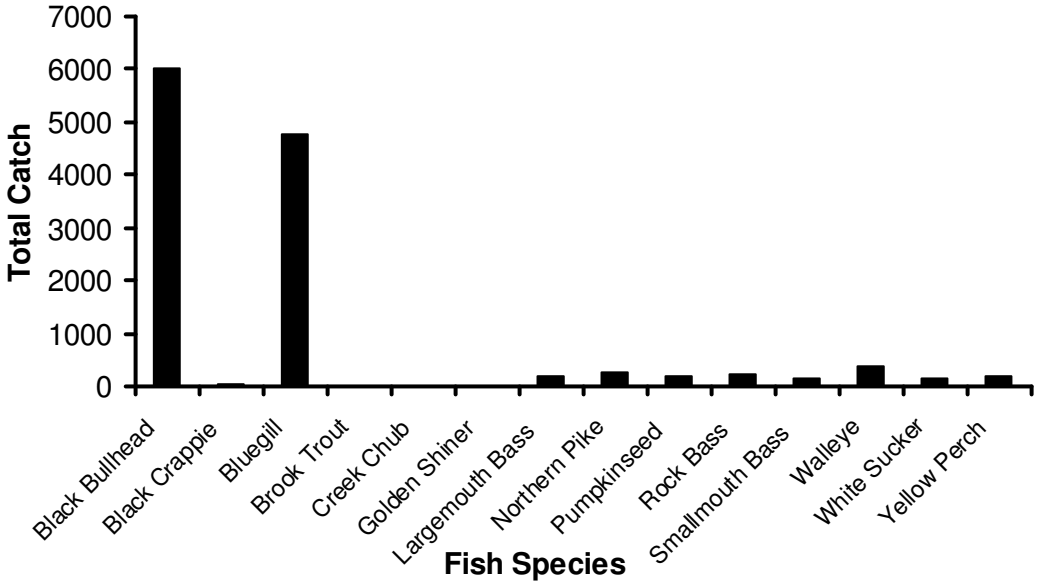

Figure 1. Fish species and number captured during the survey of Patten Lake, Florence County, 2011.

Gamefish:

Northern Pike

Abundance

Northern pike were the second most abundant gamefish species captured during our spring fyke net survey (Table 1, Appendix C). Northern pike were introduced in 1998 via a relatively small stocking of 1,050 fingerlings. This population is still in the early stages of development. Stocked fish survived well and by 2004 a natural reproducing adult population of approximately 2.1 adults per acre was established (Table 1). The northern pike population grew to an estimated 6.5 adults per acre, with a range of 1.4 to 11.6 adults per acre at the 95% confidence level, by 2011. Although the confidence range is wide for the 2011 estimate, the population does seem to be expanding. Even at the low end of the population range northern pike are the most abundant gamefish in Patten Lake.

Table 1. Abundance of northern pike, indexed by the number of estimated adults per acre, in Patten Lake, Florence County 2004-2011.

	2011	2004
Adults/Acre	6.53	2.10

*Northern pike introduced in 1998

Size Structure

A total of 152 northern pike ranging from 9.0 to 33.7 inches were measured for total length during the spring fyke netting and electrofishing surveys in 2011 (Figure 2). The average length of the northern pike measured in 2011 was 21.5 inches, nearly two inches longer then the average length of 19.6 inches measured in 2004. Modal length of northern pike measured remained unchanged since the 2004 survey at 22 inches. Size structure, indexed using relative stock density (RSD), increased from 2004 in every category except RSD34 (Table 2). This shows that the percentage of quality and preferred sized fish has increased, while fish larger than 34 inches have declined. Overall the size structure of northern pike in Patten Lake is impressive with nearly 75% of fish being ≥ 21.0 inches in length.

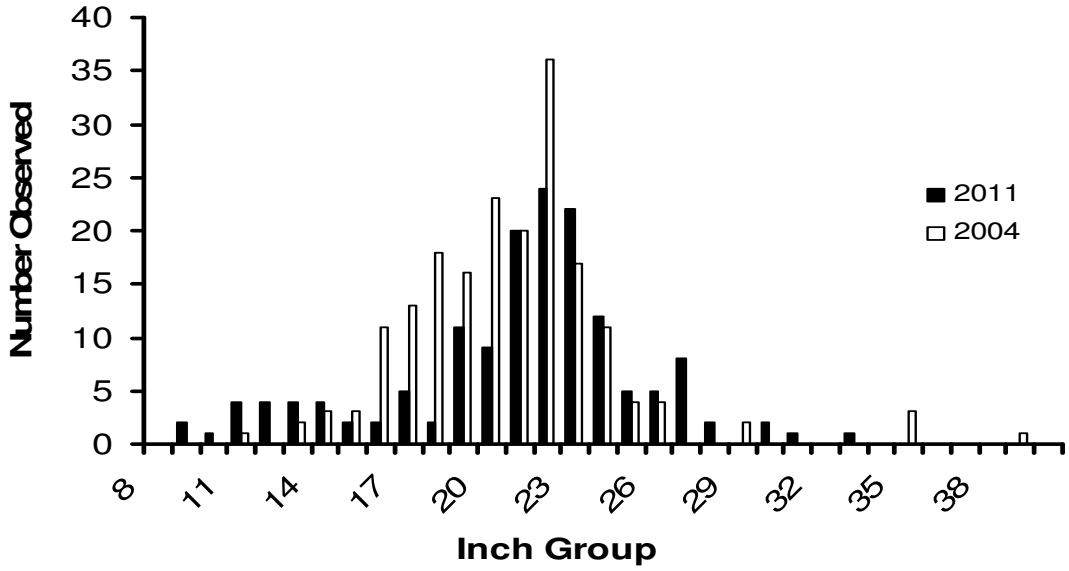

Figure 2. Length frequency of northern pike captured during spring fyke net and electrofishing surveys of Patten Lake, Florence County, during 2011 compared to 2004 (2011: N=152. 2004: N=188).

Table 2. Size structure, indexed using relative stock density, for northern pike captured during 2011 compared to 2004 for Patten Lake, Florence County (2011: N=152).

	2011	2004
RSD21	74.45	53.85
RSD24	26.28	13.51
RSD28	4.38	3.24
RSD34	0.00	2.16

Growth

Age was estimated by examining scales from a subsample of 74 northern pike during the spring 2011 fyke net survey. As expected, northern pike exhibited sexually dimorphic growth with females growing faster than males (Figure 3). Growth of female northern pike is well above the average for combined sex northern pike in the Northern Region of Wisconsin (NOR). Male northern pike showed above average growth rates until age 6 then annual growth begins to decrease to below the average for combined sex northern pike in the NOR. By combining both sexes of fish a stronger comparison can be made to the regional average and the most recent survey of Patten Lake, during which growth was expressed as both sexes combined. Northern pike sampled during 2011 showed slower growth up to age 3 and faster growth after age 3 than the population sampled in 2004 (Table 1, Appendix B). Increased growth is impressive considering the population has been expanding with an adult density loosely estimated at more than three times the 2004 density. Growth rates of Patten Lake northern pike are above the regional average until age 7 and below NOR average beyond age 7.

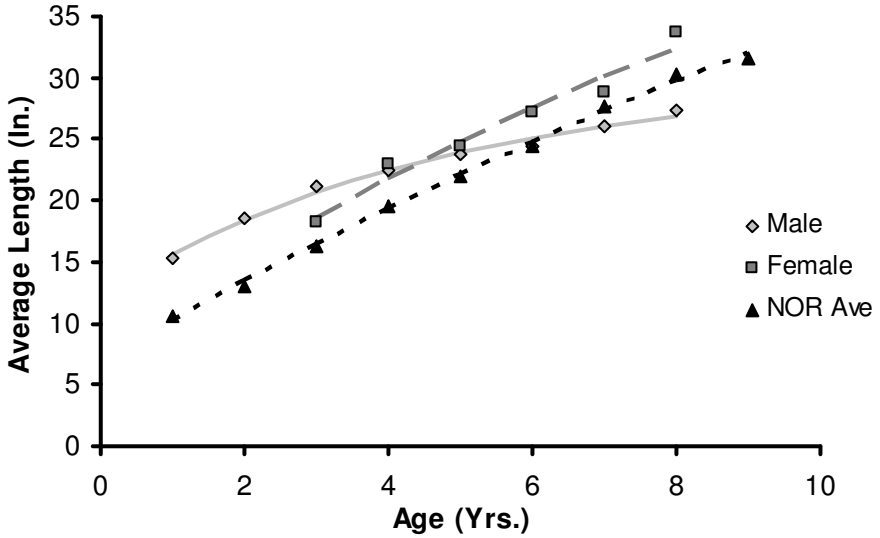

Figure 3. Average length at age for northern pike captured in Patten Lake during 2011 spring surveys, fit with von Bertalanffy growth curves and compared to the average length at age for both sexes combined in the Northern Region of WI (Male: N=53, Female: N=21).

Body Condition

A random sample of fish was weighed during our spring fyke netting survey to assess body condition of northern pike in Patten Lake. Body condition was indexed using relative weight (Wr). The Wr for male northern pike was relatively stable across all inch groups, ranging between 78.6 and 95.5 with an average of 82.2; this indicates that conditions are similar for all sizes of male northern pike in Patten Lake (Figure 4). Female Wr was less stable ranging from 77.8 to 105.6 for individual

length groups with an average of 87.8 and showing an insignificant negative relationship with total length (P=0.66). Much of the variation can be attributed to a smaller female sample size which allowed the variation in ovary condition, whether the fish had not yet deposited or had already deposited their eggs, to influence the slope of the curve. While the average Wr values for both male and female are below the standard of 100 they are adequate for waters in Northern Wisconsin.

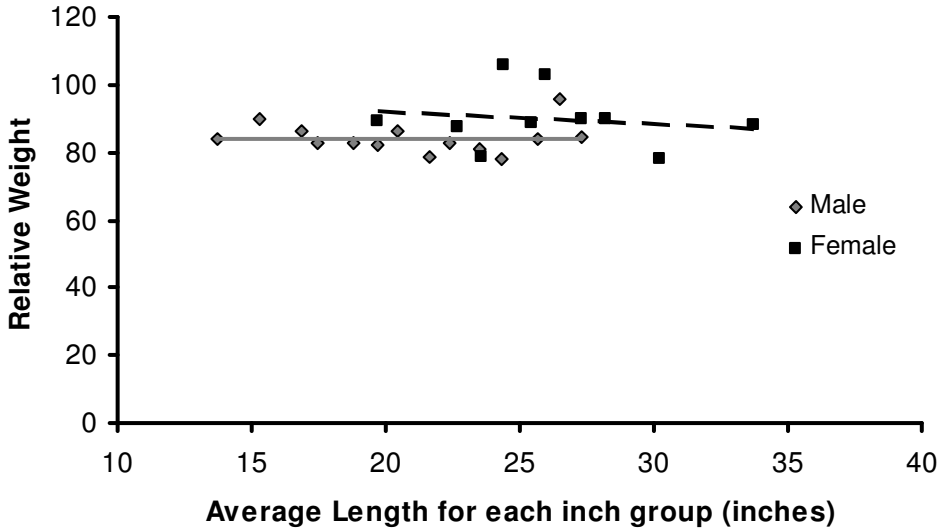

Figure 4. Average relative weight at length, measured from a sub sample of northern pike captured during spring netting of Patten Lake, Florence County, 2011 (Male: N=49, Female: N=19).

Recruitment

Recruitment of northern pike was not specifically assessed during the 2011 survey. However, during the fall electrofishing survey of Patten Lake we did catch one young-of-the-year (YOY) northern pike. The presence of this fish, along with good age distribution (Table 1, appendix B) and an increasing northern pike population proves that natural reproduction is capable of maintaining and possibly expanding the population.

Walleye

Abundance

Walleye were the most encountered gamefish species during our spring fyke netting survey at 5.42 fish per net lift (Table 1, Appendix C). The 2011 catch rate is approximately 64% lower than the spring fyke net catch rate during 2004 and nearly 70% lower than the population peak in 1993. Walleye abundance had increased from inception to 1993, but has since declined during each survey of Patten Lake (Table 3). This decrease in abundance is most easily attributed to the size limit change from a 15-inch minimum size limit to a no minimum, with only one fish over 14 inches, in 1997. The current abundance, estimated at 0.97 adults per acre, is below what is thought to be a fishable population of walleyes and below the management objectives for this naturally reproducing population of walleyes.

Table 3. Abundance of walleye, indexed by the number of estimated adults per acre, in Patten Lake, Florence County 1981-2011.

	2011	2004	2000	1993	1981
Adults/Acre	0.97	2.29	2.55	6.99	3.76

*Walleye introduced in 1974

Size Structure

A total of 110 walleye were captured and measured during our spring fyke netting survey in 2011, ranging in size from 11.2 to 29.9 inches in length (Figure 5). The mean length of walleye caught in spring fyke nets was 19.4 inches, nearly three inches larger then the mean length of 16.6 inches measured in 2004. However, the modal size of walleye decreased from 18 inches to 15 inches since 2004. A decrease in modal size was not expected with a decrease in abundance, this trend is most likely a product of a smaller sample size during 2011.

Size structure, indexed using relative stock density (RSD), has increased during each survey since 1993, showing a significant negative correlation between RSD15 and abundance (P=0.01, R2=0.978) (Table 4). RSD values for Patten Lake walleye are at an all time high for all categories except RSD30, since no fish were captured over 30 inches during 2011. This size structure is artificially high, due to poor recruitment in recent years, and is not sustainable.

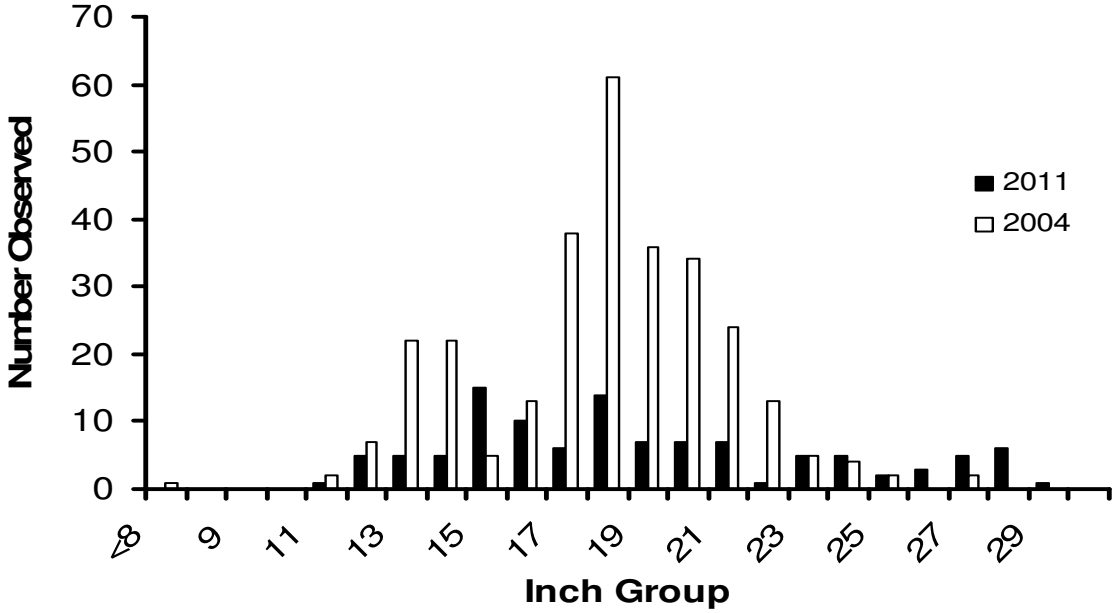

Figure 5. Length frequency of walleye captured during a spring fyke net survey of Patten Lake, Florence County, during 2011 compared to 2004 (2011: N=110, 2004: N=291).

Table 4. Size structure, indexed using relative stock density, for walleye captured during 2011 compared to previous surveys of Patten Lake, Florence County (2011: N=110).

	2011	2004	2000	1993	*1981
RSD15	85.45	81.72	76.45	33.12	75.83
RSD20	38.18	28.97	5.48	2.09	21.42
RSD25	15.45	1.38	1.61	1.24	0.00
RSD28	6.36	0.00	0.65	0.39	0.00
RSD30	0.00	0.00	0.00	0.20	0.00

*Length frequency numbers depicted from a scale drawing

Growth

Age was estimated by examining scales from a subsample of 117 walleye during the spring fyke netting and electrofishing surveys. Walleye, like northern pike, also exhibited sexually dimorphic growth with females growing faster and achieving larger overall size than males. Growth of female walleye was above average for combined sex walleye, while male walleye were above average for the first four years of life and then growth began to decrease to below the average for combined sex walleye in the NOR of WI (Figure 6). The average length at age for 2011 combined sex walleyes was very similar to those captured during 2004 through the first seven years of life, after that point the 2011 fish exhibited faster growth (Table 2, Appendix B). By combining the sexes of walleyes a better comparison can be made to the 2004 survey and NOR averages. Combined sex walleye of Patten Lake show above average growth from age 1 through 4, and again after age 7, with very similar average length at age during years 5-7, when compared to the NOR average. The impressive growth of Patten Lake walleye suggests that fish are taking advantage of reduced intraspecific competition at the current low population level, especially later in life.

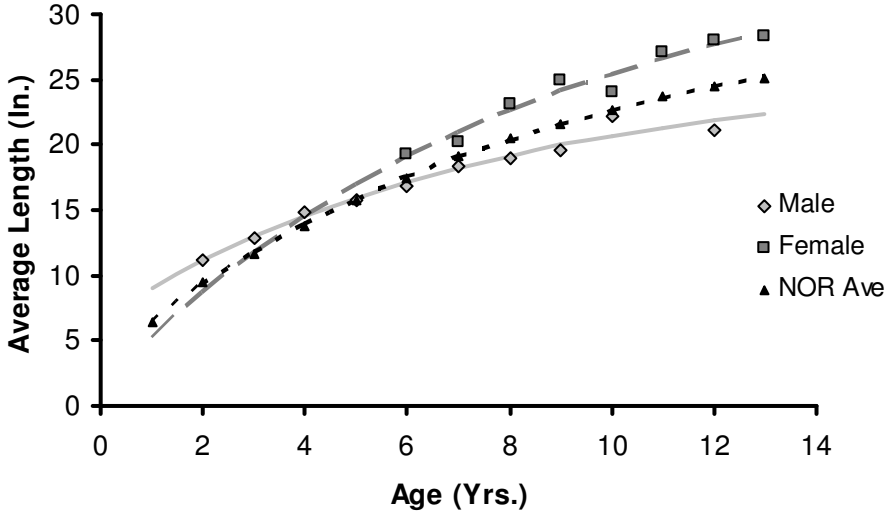

Figure 6. Average length at age for walleye of each sex, captured from Patten Lake during 2011 spring surveys, fit with von Bertalanffy growth curves and compared to the average length at age for the Northern Region of WI (Male: N=69, Female: N=36).

Body Condition

A random sample of fish was weighed during our spring fyke netting survey to assess body condition of walleye in Patten Lake. Relative weight (Wr) was used to index body condition for both sexes of walleye. Wr for male walleye was steady ranging between 77.9 and 88.7 for individual inch groups, with an average of 85.4 (Figure 7). Female Wr was slightly more variable ranging from 82.9 to 107.1, averaging 93.3. Female Wr had an insignificant positive correlation with total length (P=0.50). This suggests that conditions are similar, including the amount of metabolic energy used to capture each unit of forage, for male and female walleye as other sized individuals within their own sex. Like northern pike the Wr values are below the standard but are adequate for waters in Northern Wisconsin.

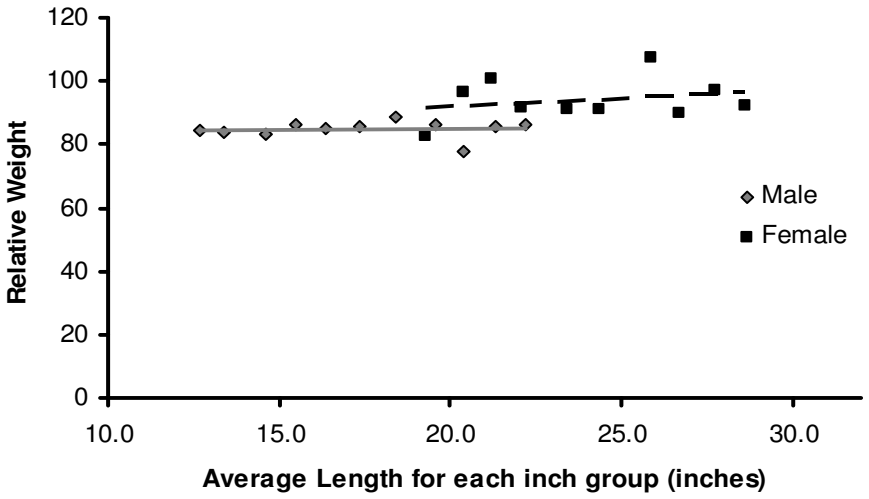

Figure 7. Average relative weight at length, measured from a sub sample of walleye captured during spring netting and electrofishing surveys of Patten Lake, Florence County, 2011 (Male: N=66, Female: N=40).

Recruitment

A walleye recruitment survey was conducted on 10/1/2011. During this survey we captured a total of 60 young-of-the-year (YOY) walleye, a catch rate of 15.8 YOY walleye/mi., ranging in size from 4.4 to 7.7 inches in length. This was the second highest catch rate of YOY walleye in the last 7 years (Figure 8). A total of 74 age-1 walleye, 19.5 per mile, were also captured during this survey. This suggests good survival of the 2010 year-class (the largest year class in the past 7 years).

High natural recruitment of walleyes was measured during past surveys of Patten Lake, with year classes over 100 YOY/mi. in 2001, 2002 and 2004 (Table 5, Appendix C). Good recruitment along with the high adult densities documented in 1993 was the rationale for the current "no minimum" length limit. However, recruitment has been low since 2004, which is one of the factors causing the shift in size structure (Figure 3) and adult population (Table 3) to the current levels.

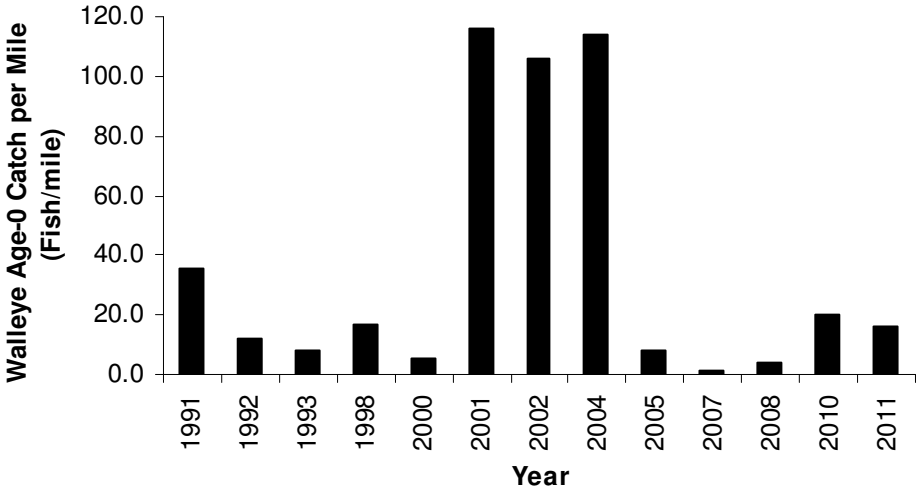

Figure 8. Walleye recruitment, indexed using catch per mile of age-0 walleye during fall electrofishing surveys, in Patten Lake, Florence County, 1991-2011

Largemouth Bass

Abundance

Spring netting along with five electrofishing surveys were conducted to estimate the largemouth bass population in Patten Lake, during these surveys we captured 112 different largemouth bass (Table 2, Appendix A). The data collected during our mark-recapture survey estimated the largemouth bass population to be approximately 288 (1.13/acre) fish $\geq$ 8.0 inches, with a 95% confidence interval creating a range between 0.60 and 1.65 fish $\geq$ 8.0 inches per acre. This was the first time the largemouth bass population had been estimated. However, during the 1981 survey of Patten Lake a total of 294 largemouth bass were captured, more than the current population estimate. This suggests that largemouth bass were more abundant in the past than they are in present day. An easy explanation for the decrease in abundance is the addition of three other gamefish species that were not native to Patten Lake, those being; smallmouth bass, walleye and northern pike.

Size Structure

During 2011 we sampled a total of 112 different largemouth bass up to 20.8 inches in total length (Figure 9). The average length of the largemouth bass captured during 2011 was 14.6 inches, over 2 inches longer then the 12.5-inch average measured in 1981. The majority of the bass sampled (63.3%) were between 13.0 and 18.9 inches during the 2011 survey. During the 1981 survey, when bass were relatively more abundant the majority of the fish captured (55.4%) were between 10.0 and 12.9 inches. This data shows that Patten Lake currently supports a higher quality largemouth bass fishery than it did 30 years ago.

Size structure, indexed using relative stock density (RSD), has increased significantly since 1981 (Table 5). At present, approximately 78% of the largemouth bass are larger than 12.0 inches, and an incredible 3.6% are larger than 20.0 inches. However, during the 1993 survey a small sample of largemouth bass were measured which revealed even better size structure than the current level, with 92.1% of bass measured being $\geq$ 15.0 inches and a staggering 15.8% larger than 20.0 inches. At the time of the 1993 survey largemouth recruitment was very low, thought to be caused by competition with the high density of walleye. The 1993 sampling of largemouth bass could be displaying an artificially high size structure due to limited natural reproduction during the previous few years when walleyes were abundant; nonetheless, the size structure measured in 1993 shows the tremendous potential for trophy largemouth bass in Patten Lake.

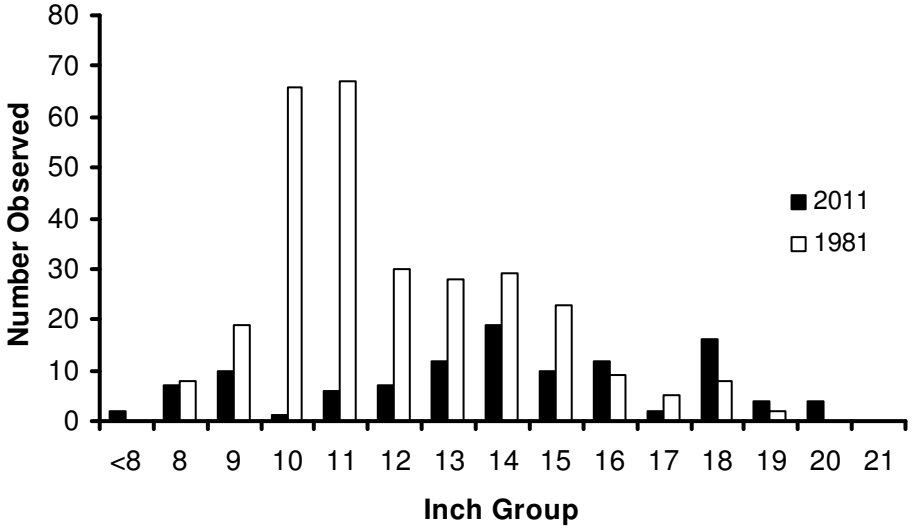

Figure 9. Length frequency of largemouth bass captured during spring fyke netting and electrofishing surveys of Patten Lake, Florence County, during 2011 compared to 1981 (2011: N=112, 1981: N= 294).

Table 5. Size structure, indexed using relative stock density, for largemouth bass captured during 2011 compared to previous surveys of Patten Lake, Florence County (2011: N=112).

	2011	*1993	1981
RSD12	78.18	97.37	45.58
RSD15	43.64	92.11	23.38
RSD18	21.82	44.74	4.98
RSD20	3.64	15.79	0.00

*Only 38 fish sampled

Growth

During most of our sampling effort we were unable to visually determine the sex of largemouth bass, so fish of both sexes were grouped into a single category of unknown sex largemouth bass. Scales were collected from a subsample of 85 largemouth bass to estimate age. Growth was then indexed using average length at age compared to the average for the Northern Region (NOR) of Wisconsin (Figure 10). Patten Lake largemouth bass exhibited below average growth until age 7 and above average growth beyond age 7 when compared to other populations in the NOR of Wisconsin (Table 3, Appendix B). This impressive growth later in life is probably due to many different attributes of the Patten Lake fishery, one of these being the relative low density of largemouth bass.

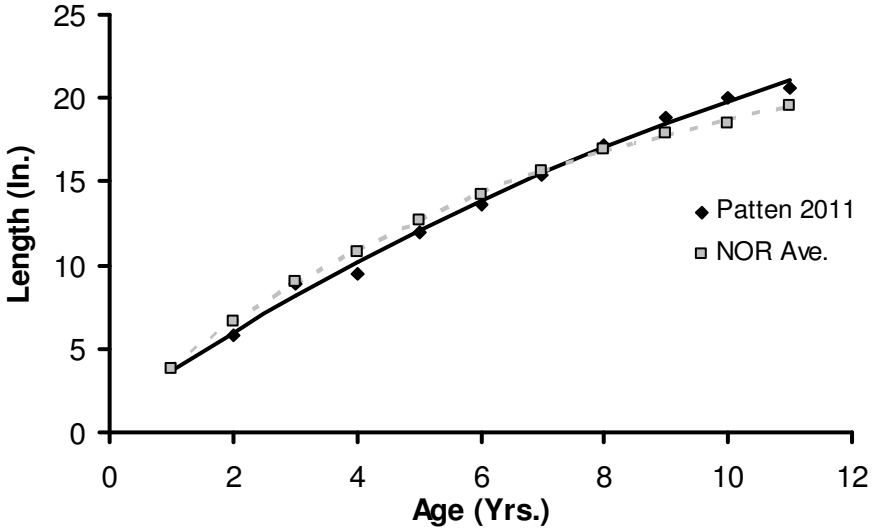

Figure 10. Average length at age for largemouth bass captured during 2011 spring surveys, fit with von Bertalanffy growth curves and compared to the average length at age for the Northern Region of WI (N=85).

Body Condition

Randomly selected fish were weighed during our spring surveys to assess body condition of largemouth bass via relative weight analysis. Wr values for both sexes combined ranged from 101.2 to 117.5, with an average value of 108.9 (Figure 11). This high average Wr value along with very little change in Wr with length suggests that conditions are very good for largemouth bass of all sizes within Patten Lake.

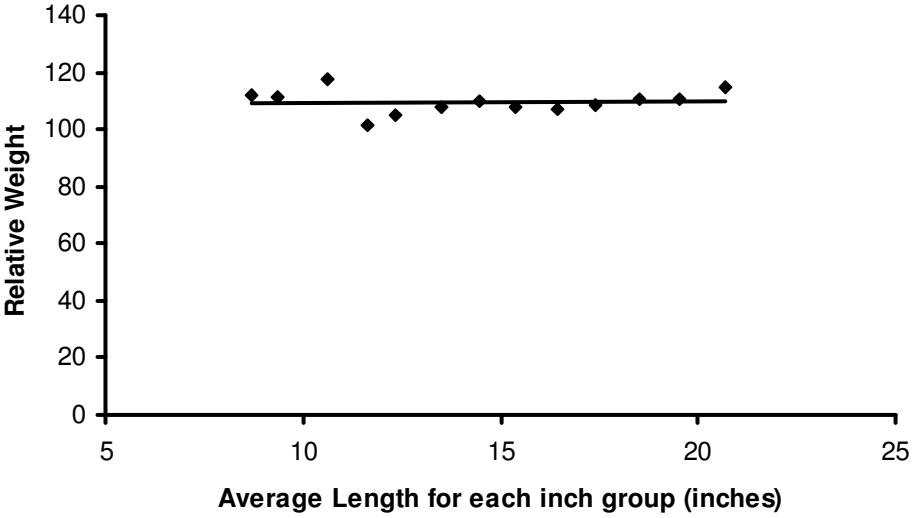

Figure 11. Average relative weight at length, measured from a sub sample of largemouth bass captured during spring netting and electrofishing surveys of Patten Lake, Florence County, 2011 (N=85).

Recruitment

Prior to the introduction of walleyes, northern pike and smallmouth bass Patten Lake had a larger population of largemouth bass. This would suggest that natural recruitment of largemouth bass was better in the past. In fact, during the 1993 survey of Patten Lake during which natural reproduction of largemouth bass was not found it was stated, "Competition with largemouth bass (…and walleye) for food and cover has limited bass recruitment and reproduction in Patten Lake" (Heizer 1993). The relatively low adult population estimate this year suggests that natural reproduction of largemouth bass has not significantly increased since the walleye population began decreasing in the late 1990's.

During our fall electrofishing survey we attempted to index recruitment of all gamefish using average catch per mile of young-of-the-year (YOY) gamefish. However, the survey had an emphasis on walleye so other gamefish, including largemouth bass, were only captured if walleyes were not present, which was a very small segment of our survey. We did capture 13 YOY largemouth bass ranging from 1.5-3.4 inches in length and 16 yearling largemouth bass from 6.0 to 7.9 inches. This was only a small percentage of what could have been captured as we witnessed a very large 2011 year class of largemouth bass, more abundant than all other YOY game fish.

Smallmouth Bass

Abundance

Spring fyke netting along with five electrofishing surveys were conducted to estimate the smallmouth bass population in Patten Lake. The data collected during these surveys estimated the smallmouth bass population to be approximately 230 (0.90/acre) fish $\geq$ 8.0 inches, with a 95% confidence interval creating a range between 0.49 and 1.31 fish $\geq$ 8.0 inches per acre. This was the first time the smallmouth bass population had been estimated in Patten Lake. In fact, smallmouth bass were not even observed during the 1993 comprehensive and creel survey. Only 17 were captured during spring electrofishing surveys in 2004. This suggests that the smallmouth bass population is growing, or has been growing, in Patten Lake.

Size Structure

During 2011 we captured 97 different smallmouth bass up to 20.9 inches during spring sampling (Table 4, Appendix A). The average length of smallmouth bass captured during spring surveys was 14.5 inches, with a mode of 10 inches (Figure 12). Size structure, indexed using relative stock density (RSD), was quite impressive with more than 59% of the fish of stock length being $\geq$ 14.0 inches and over 4% being $\geq$ 20.0 inches (Table 6).

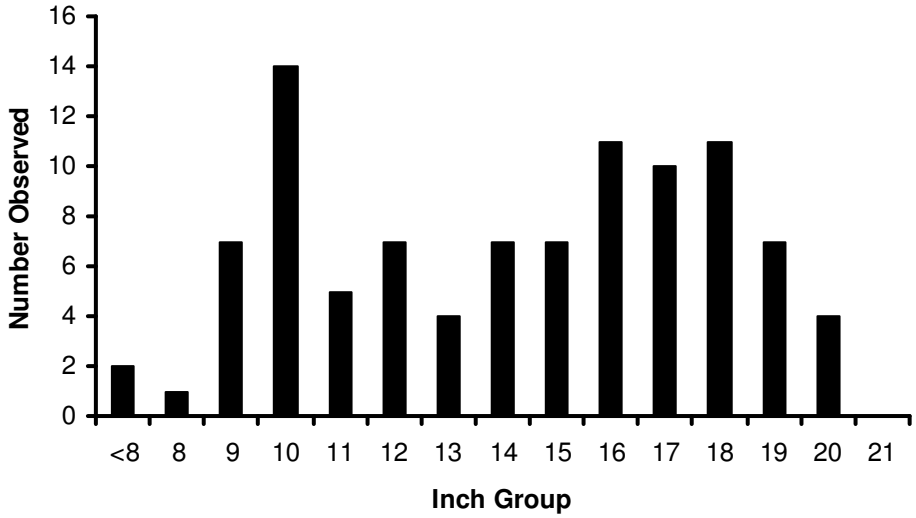

Figure 12. Length frequency of smallmouth bass captured during spring electro fishing surveys of Patten Lake, Florence County, 2011 (N=97).

Table 6. Size structure, indexed using relative stock density, for smallmouth bass captured during 2011 surveys of Patten Lake, Florence County (2011: N=97).

	2011
RSD11:	76.04
RSD14:	59.38
RSD17:	29.17
RSD20:	4.17

Growth

Growth was indexed using average length at age from a subsample of 86 smallmouth bass during the 2011 survey (Figure 13). Patten Lake smallmouth bass showed growth above the Northern Region average for all ages (Table 4, Appendix B).

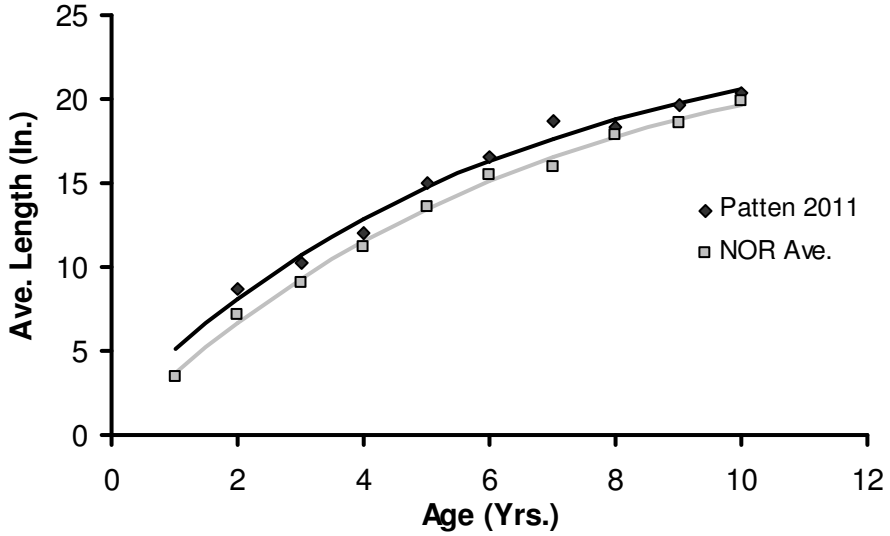

Figure 13. Average length at age for smallmouth bass captured during 2011 spring electrofishing two surveys, fit with von Bertalanffy growth curves and compared to the average length at age for the Northern Region of WI (N=86).

Body Condition

During our sampling efforts we obtained weight measurements from 88 of the 97 smallmouth bass captured. Relative weight (Wr) was used to index body condition of smallmouth bass. Wr values for both sexes combined ranged from 85.8 to 103.4, with an average of 93.4 (Figure 14). These are acceptable values of Wr for smallmouth bass in our northern climate. However, linear regression analysis proves that there is a significant negative correlation between relative weight and average length for smallmouth bass in Patten Lake ($P=0.0004$, $R^2=0.735$). This negative relationship between body condition and length suggests that conditions are better in Patten Lake for shorter/younger smallmouth bass and lacking for longer/older individuals.

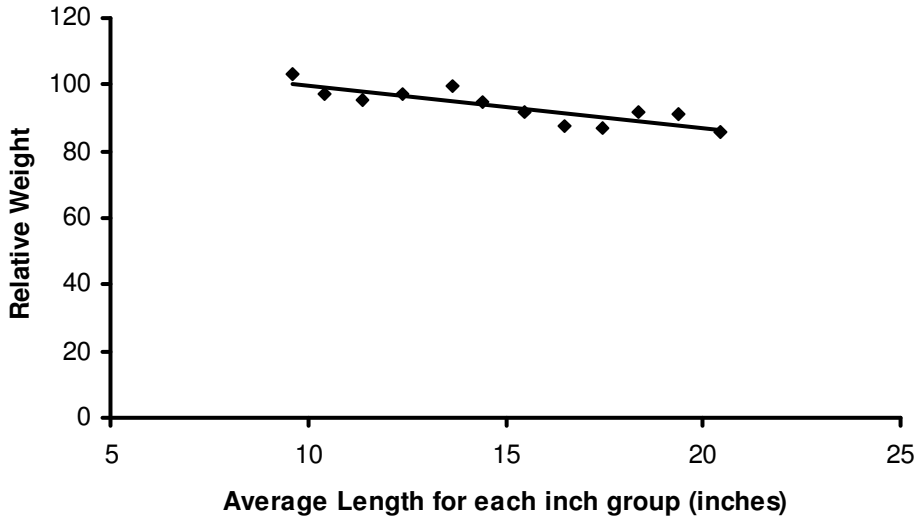

Figure 14. Average relative weight at length, measured from a sub sample of smallmouth bass captured during spring netting and electrofishing surveys of Patten Lake, Florence County, 2011 (N=88).

Recruitment

Recruitment was indexed using catch per mile of young-of-the-year (YOY) fish during our fall electrofishing survey in 2011. Smallmouth bass YOY were less abundant than largemouth bass YOY with only 4 captured. However, just like largemouth bass, smallmouth bass were not a primary target during this survey and they were only collected when no walleyes were around. Nonetheless, the seemingly growing population along with naturally recruited YOY smallmouth bass suggests that the population is capable of maintaining itself naturally.

Panfish:

Bluegill

Relative Abundance

Bluegill were the most abundant panfish species during summer fyke netting with a total of 4,384 fish captured (50.98 fish/net lift) (Table 3, Appendix C). However, this is still only about half of the last recorded summer netting catch rate of bluegills from 1967.

Size Structure

A random sample of 316 bluegill were measured during our summer pan fish survey. These fish ranged from 3.6 to 8.8 inches in length with a modal length of 5 inches (Figure 15). Size structure of bluegill was good with RSD6 and RSD8 values of 52.2 and 5.4 respectively (Table 7). However, these RSD values are substantially less than values recorded in 1993 and 1981.

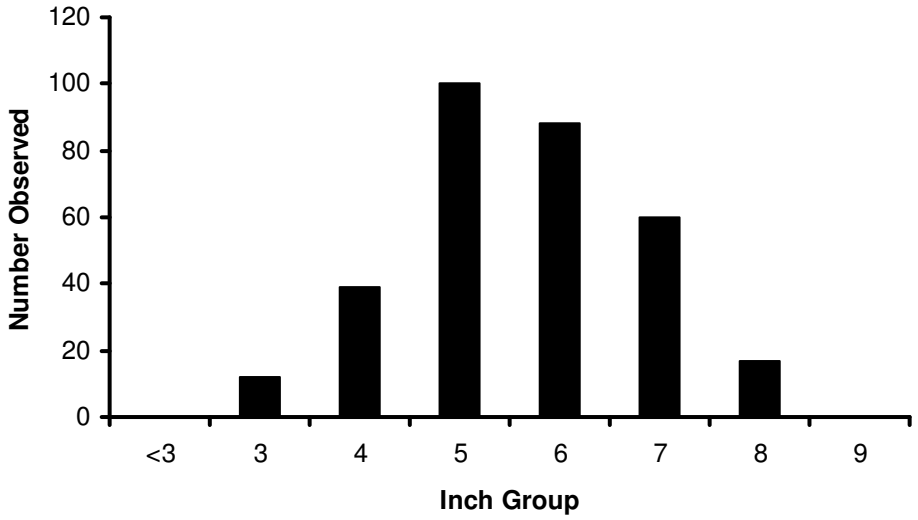

Figure 15. Length frequency for a subsample of bluegill captured during a summer fyke net survey of Patten Lake, Florence County, 2011 (N=316).

Table 7. Size structure, indexed using relative stock density, for a subsample of bluegill captured during 2011 compared to previous surveys of Patten Lake, Florence County (2011: N=316).

	2011	1993	1981	1974
RSD6	52.22	86.96	81.17	37.13
RSD7	24.37	63.04	55.47	5.98
RSD8	5.38	26.09	29.26	2.78
RSD9	0.00	4.35	6.87	0.70
RSD10	0.00	2.17	0.25	0.00

Growth

Growth was indexed using average length at age from a random sample of 57 bluegill. Growth of bluegill in Patten Lake is above average for the Northern Region of Wisconsin (Figure 16).

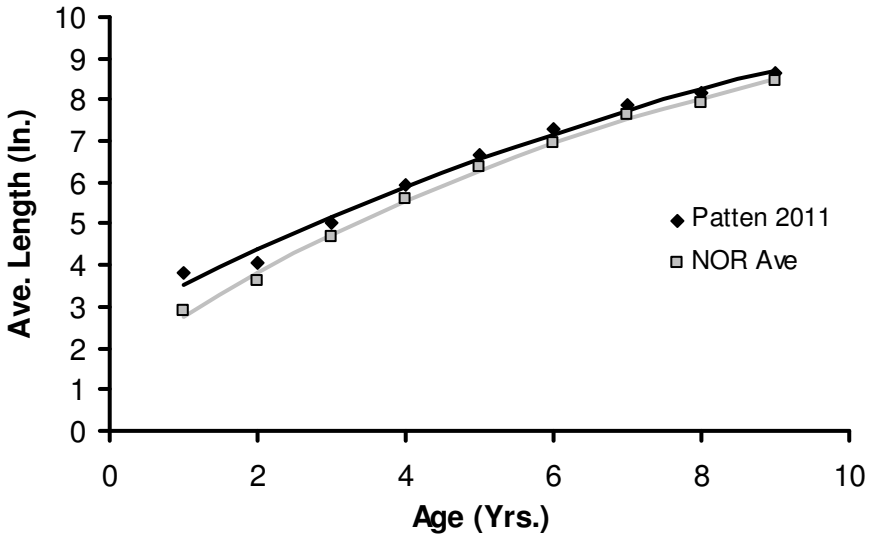

Figure 16. Average length at age for a subsample of bluegill captured during summer sampling 2011, fit with von Bertalanffy growth curves and compared to the average length at age for the Northern Region of WI (N=57).

Rock Bass

Relative Abundance

Rock bass were the second most abundant panfish during summer fyke netting with a total of 216 rock bass sampled (2.51 fish/net lift) (Table 3, Appendix C). Like bluegill, the catch rate of rock bass has declined since 1967.

Size Structure

A sample of 48 rock bass ranging in size from 4.4 to 8.4 inches, with a modal length of 7 inches, were measured during 2011 (Figure 17). Size structure was indexed using relative stock density and showed poor size structure of rock bass in Patten Lake (Table 8).

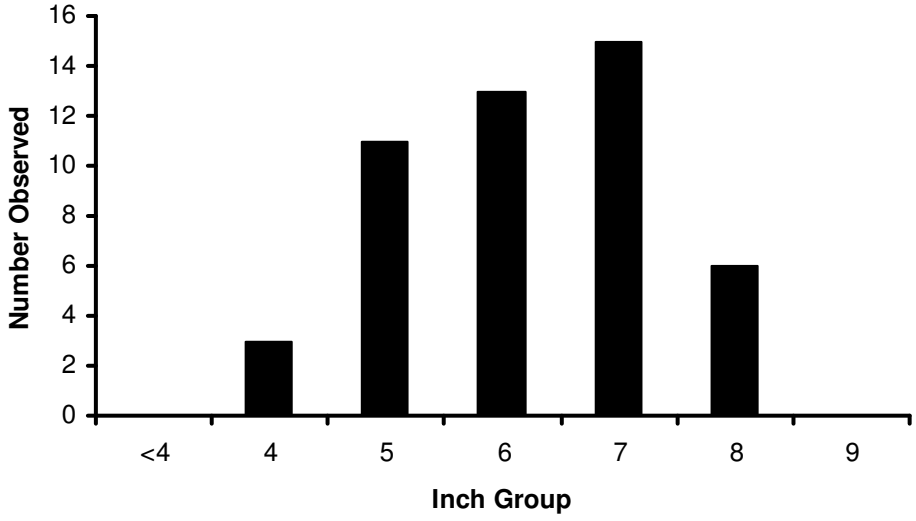

Figure 17. Length frequency for a subsample of rock bass captured during a summer fyke net survey of Patten Lake, Florence County, 2011 (N=48).

Table 8. Size structure, indexed using relative stock density, for a subsample of rock bass captured during 2011 compared to previous surveys of Patten Lake, Florence County (2011: N=48).

	2011	1993	1981	1974
RSD7	43.75	60.49	25.85	30.19
RSD8	12.50	19.75	9.27	16.98
RSD9	0.00	6.17	2.44	1.89
RSD10	0.00	0.00	0.00	0.00

Growth

Scale samples were taken from 30 rock bass during our summer fyke net survey. Age was estimated from these scales and average length at age was used to index growth. Growth rates of rock bass in Patten Lake are near the state average, with below average growth early in life and after age 6 (Figure 18).

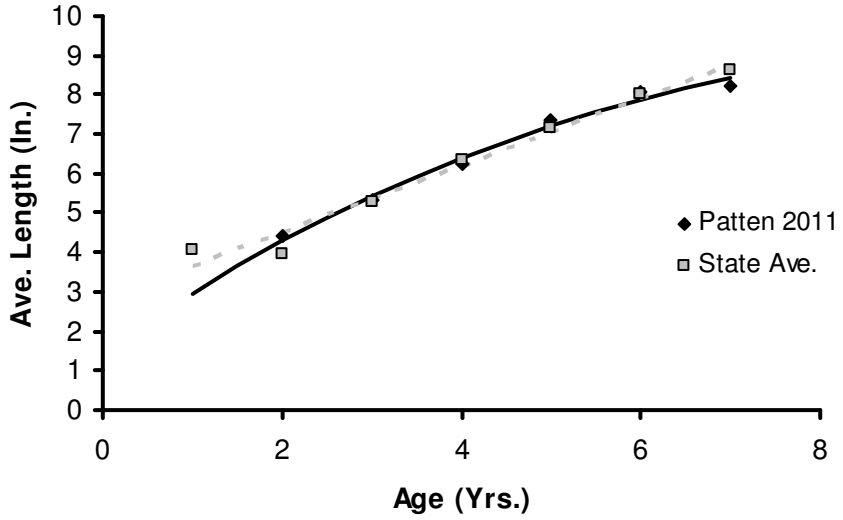

Figure 18. Average length at age for a subsample of rock bass captured with fyke nets in 2011, fit with von Bertalanffy growth curves and compared to the average length at age for the State of WI (N=30).

Pumpkinseed

Relative Abundance

Pumpkinseed were less abundant than bluegill and rock bass during our summer survey. A total of 181 pumpkinseeds (2.1 fish/net lift) were captured in 2011 (Table 3, Appendix C).

Size Structure

A subsample of 86 Pumpkinseed were measured ranging in size from 3.4 to 6.6 inches, with the largest number being in the five-inch class were measured (Figure 19). This is very poor size structure, with only about 15% of fish being $\geq$ 6.0 inches (Table 9).

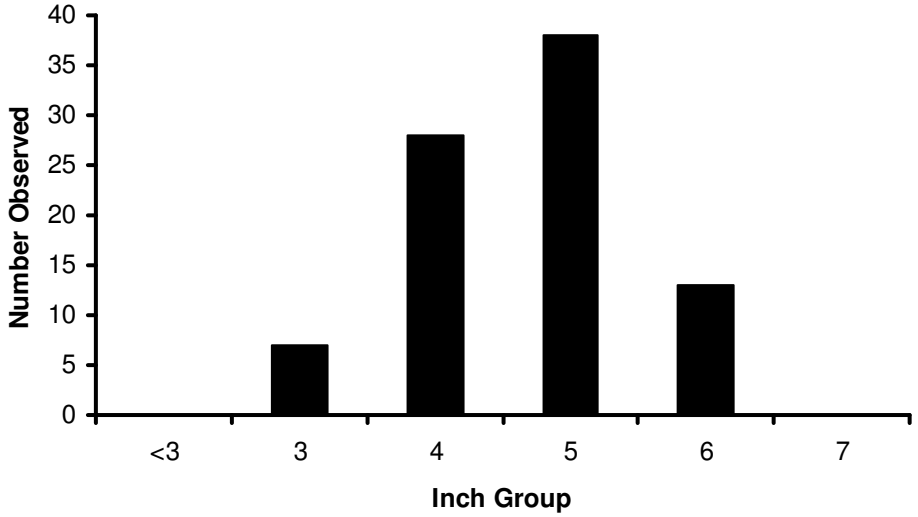

Figure 19. Length frequency for a subsample of pumpkinseed captured during a summer fyke net survey of Patten Lake, Florence County, 2011 (N=86).

Table 9. Size structure, indexed using relative stock density, for a subsample of pumpkinseed captured from Patten Lake, Florence County, 2011 (N=86).

	2011
RSD6	15.12
RSD8	0
RSD10	0

Growth

Scale samples were taken from 36 pumpkinseed for age estimation. Average length at age for pumpkinseed was near the state average (Figure 20).

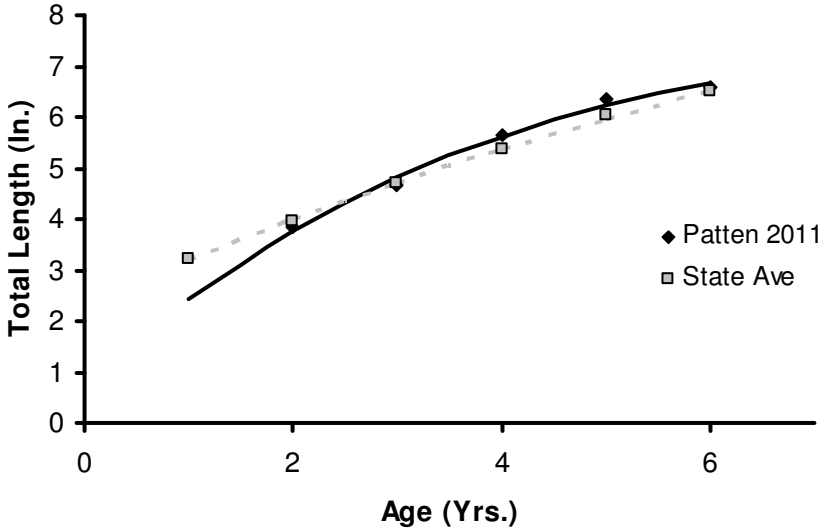

Figure 20. Average length at age for a subsample of pumpkinseed captured with fyke nets during summer sampling 2011, fit with von Bertalanffy growth curves and compared to the average length at age for the State of WI (N=36).

Yellow Perch

Relative Abundance

Yellow perch were not very abundant in Patten Lake during 2011. A total of 88 yellow perch were captured during spring netting and another 93 (1.08 fish/net lift) were captured during summer netting (Figure 3, Appendix C).

Size Structure

A subsample of 77 yellow perch was measured during 2011 with the largest being 9.4 inches in length (Figure 21). The yellow perch population in Patten Lake has very poor size structure, with just over 6% of fish being ≥ 8.0 inches. Poor yellow perch size structure has been typical of Patten Lake with poor relative stock density (RSD) values during previous pan fish surveys in 1974 and 1981 (Table 10).

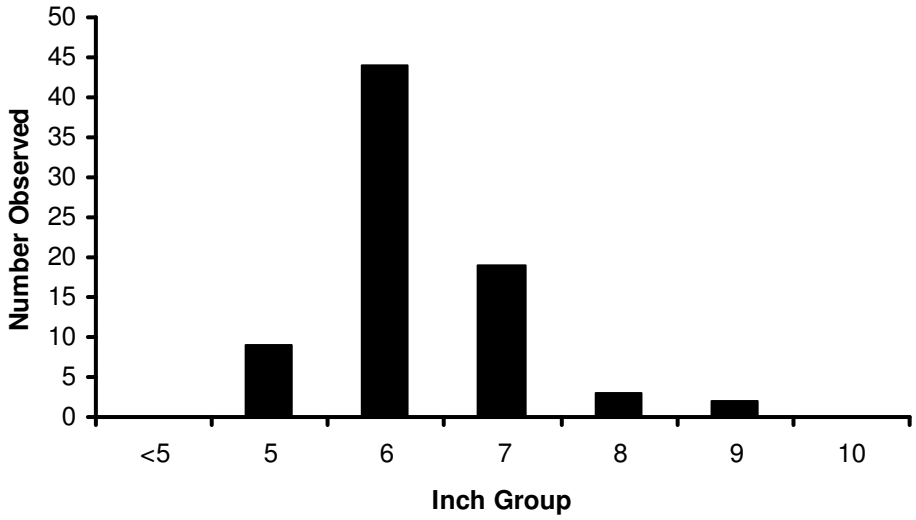

Figure 21. Length frequency for a subsample of yellow perch captured during a summer fyke net survey of Patten Lake, Florence County, 2011 (N=77).

Table 10. Size structure, indexed using relative stock density, for a subsample of yellow perch captured during 2011 compared to previous surveys of Patten Lake, Florence County (2011: N=77).

	2011	1981	1974
RSD8	6.49	9.36	17.31
RSD9	2.60	2.46	1.92
RSD10	0.00	0.00	0.00

Growth

Average length at age was derived using estimated age from scale samples taken from 39 randomly selected yellow perch (Figure 22). The growth curve of yellow perch in Patten Lake mirrors the average growth curve for the Northern Region of Wisconsin.

Figure 22. Average length at age for yellow perch captured with fyke nets during the spring of 2011, fit with von Bertalanffy growth curves and compared to the average length at age for the Northern Region of WI (N=39).

Black Crappie

Relative Abundance

Black crappie were rare during the 2011 survey of Patten Lake. A total of 7 and 36 crappies were captured during spring and summer netting periods (Table 6, Appendix C).

Size Structure

Of the 43 black crappie captured in 2011, 22 were measured for total length with the largest being 13.0 inches long (Figure 23). Size structure of black crappie was good with over 36% of fish measured being ≥ 12.0 inches in length (Table 11).

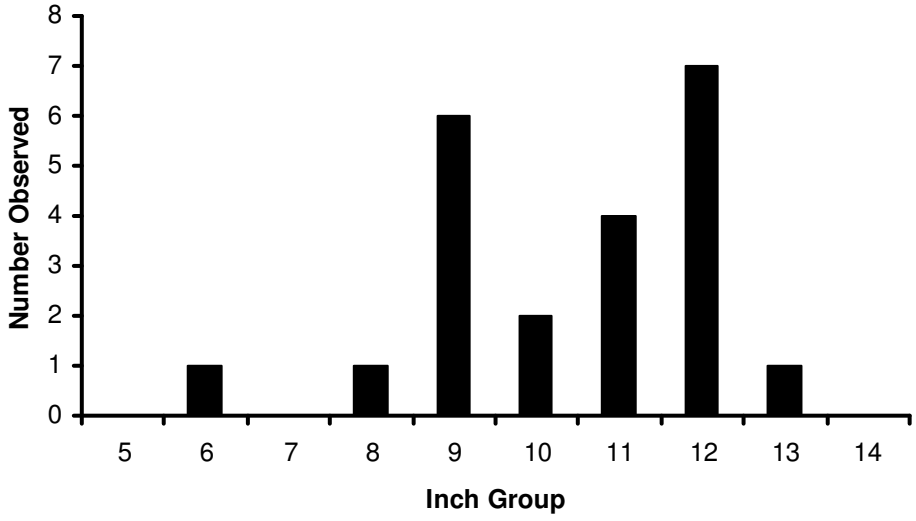

Figure 23. Length frequency for a subsample of black crappie captured during spring and summer fyke net surveys of Patten Lake, Florence County, 2011 (N=22).

Table 11. Size structure, indexed using relative stock density, for a subsample of black crappie captured from Patten Lake, Florence County, 2011 (N=22).

	2011
RSD8	95.45
RSD10	63.64
RSD12	36.36
RSD14	0.00

Growth

Scales were taken from 21 black crappies to compute average length at age. Black crappies in Patten Lake exhibit fairly average growth rates for the Northern Region of Wisconsin (Figure 24).

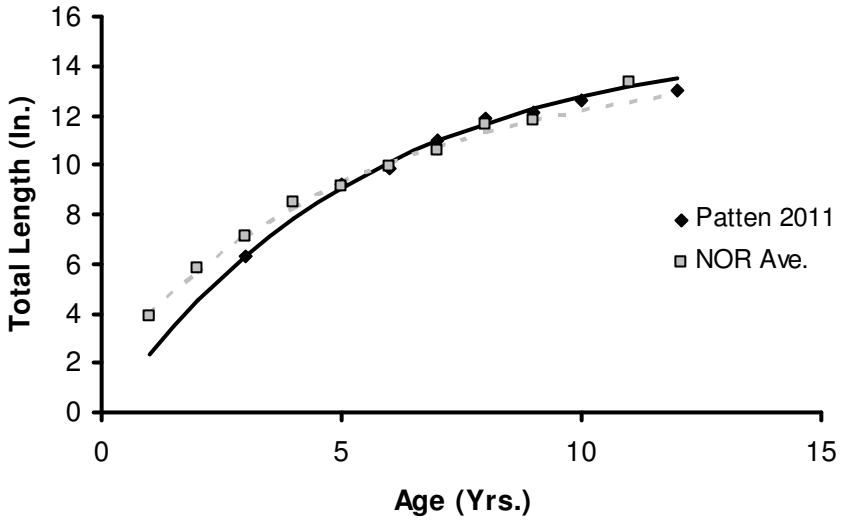

Figure 24. Average length at age for black crappie captured with fyke nets in 2011, fit with von Bertalanffy growth curves and compared to the average length at age for the Northern Region of WI (N=21).

Black Bullhead

Relative Abundance

During the 2004 survey of Patten Lake "bullheads were relatively much more numerous than the other panfish" (Young, 2004). Black bullheads were again the most numerous pan fish species captured during spring netting with an initial catch rate of 93.6 fish/net-night. All black bullheads were removed during spring netting, reducing the catch rate of black bullheads to an average of 56.7 fish/net-night during spring surveys (Figure 25). Black bullheads had the highest catch rate of all fish species during spring fyke net surveys (Table 4, Appendix C).

During the 17-day bullhead removal period black bullheads were the second most abundant fish species captured with an average daily catch rate that varied from 9.7 to 35.7 bullheads/net-night (Figure 26). Summer bullhead catch rates initially dropped as bullheads were being removed from the population, but then began to increase as we allowed nets to soak for multiple days to attract spawning bullheads and moved nets to new areas to exploit new colonies of bullheads.

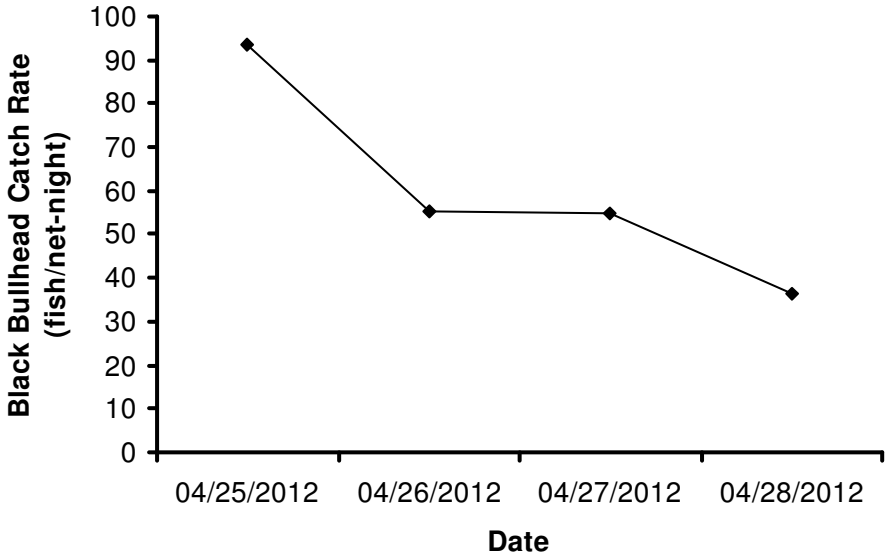

Figure 25. Black bullhead catch rate during spring fyke netting of Patten Lake, Florence County, 2011 (All black bullheads captured were removed).

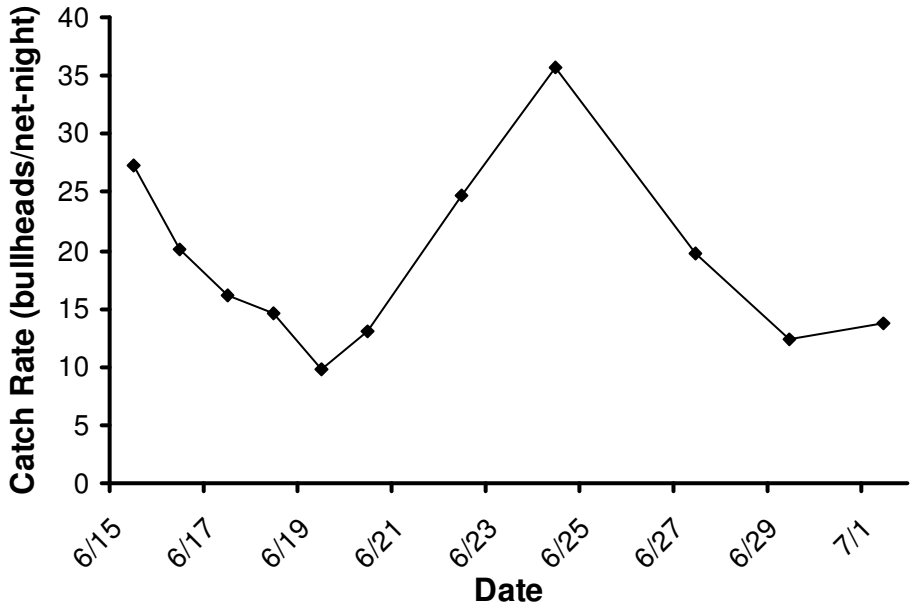

Figure 26. Black bullhead catch rate during a 17-day bullhead removal project on Patten Lake, Florence County, 2011 (All black bullheads captured were removed).

Size Structure

A 57 fish subsample of black bullhead was measured during 2011. These fish ranged in size from 7.3 to 10.4 inches, with the majority in the nine-inch class (Figure 27). The majority of the fish were of quality size with two-thirds being $\geq$ 9.0 inches. However, no fish of preferred size (12 inches) or larger were measured in 2011, exhibiting poor size structure for preferred sized fish.

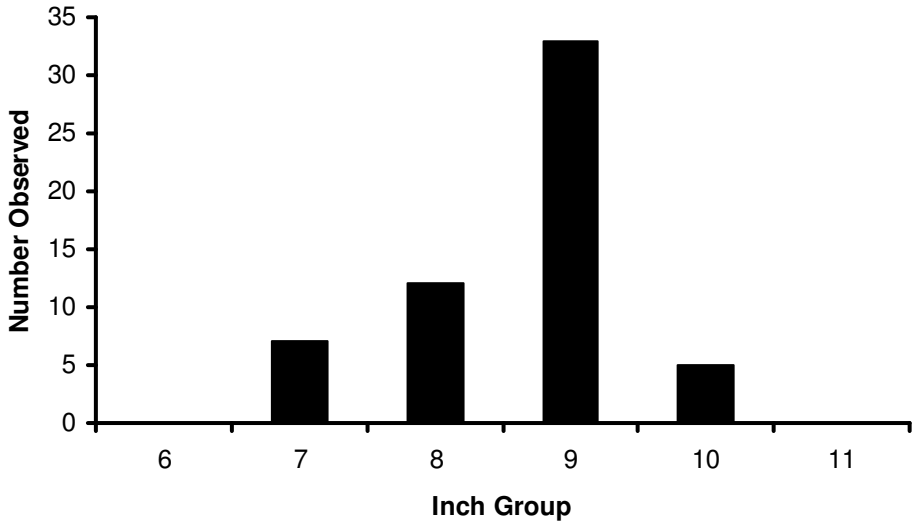

Figure 27. Length frequency of a subsample of black bullhead captured during a summer fyke net survey of Patten Lake, Florence County, 2011 (N=57).

Bullhead Removal

High catch rates of black bullheads were originally documented during spring 1993 (Table 4, Appendix C) and then again during summer 2004 when 102.3 bullheads/net lift were recorded. In recent years there has been many angler complaints about the over abundant bullhead population, these angler complaints were validated by visual observations during a fall gamefish recruitment survey in October 2010. Poor recruitment of walleyes over the past seven years gave way to a reasonable assumption that the abundant bullhead population may be having a negative affect on walleye recruitment.

So during the 2011 fisheries survey we removed every black bullhead captured during two fyke net surveys; 4 days during spring and an extended 17-day bullhead removal period during summer. During the summer bullhead removal period net locations were changed frequently in hopes of exploiting new colonies of spawning bullheads (net locations available at the back of this report). One thousand four hundred and seventy-four black bullheads were removed during the spring period, combined with the 4,525 bullheads removed during the summer period made a total of 5,999 black bullheads weighing an estimated 2,580 pounds removed from Patten Lake in 2011.

Certain members of the Patten Lake Association were permitted through the WDNR to remove young-of-the-year (YOY) bullheads via net while they huddle in large groups near shore. This effort resulted in the removal of approximately 6,500-7,500 YOY bullheads.

The hope is that removal of bullheads will result in more consistent and larger year classes of YOY and age-1 walleyes. However, the overall goal is to set the bullhead population back to a controllable level and reallocate the biomass currently taken up by black bullheads to other, more desirable, fish species.

V. MANAGEMENT RECOMMENDATIONS

Northern Pike

Northern pike appear to be growing in abundance, becoming the most abundant gamefish within Patten Lake in only 13 years. At an estimated 6.53 adults per acre this is one of the most dense northern pike fisheries in Florence County. Body condition and growth for northern pike in Patten Lake are impressive given the level of abundance, creating quite an angling opportunity. I anticipate a change in abundance or size structure, body condition and growth as we reduce the abundance of black bullheads which have likely been a good forage base for northern pike. Continued monitoring of the pike population is vital to understand how this population adapts to the reduction of black bullheads. The current no minimum length limit, five fish daily bag is the best option for Patten Lake. Angler harvest of northern pike should be encouraged to keep the population from becoming over abundant.

Walleye

Since the introduction of walleyes in 1974, 76 and 78 walleyes have found Patten Lake suitable for natural reproduction. In fact, Patten Lake is the only lake in Florence County capable of maintaining a fishable ($\geq$ 1 adult/acre) walleye population through natural reproduction. Under the 15-inch minimum length limit walleye natural reproduction was high enough to cause density related growth and size structure problems. However, since the no minimum length limit has been in effect (1997) there have only been three large year classes measured (Table 5, Appendix C). There have also been major changes to the fish community, especially gamefish populations, which should biologically limit walleye abundance and reduce density related problems to the walleye population going forward.

Since 2005, the lack of natural walleye recruitment has produced only minor year classes of walleyes, causing the size and age structure to shift to older/larger individuals, without strong year classes of young walleye (Figure 5). This has created a fishery with an amazing, yet non-maintainable size structure. Reduction of black bullheads, along with a more restrictive regulation to protect young walleyes should bring the walleye population to a more normal level with a larger base of young fish, increasing the sustainability of the walleye population.

The long-term goal for the Patten Lake walleye population is to make walleyes the dominant game fish species with a population higher than all other game fish. This goal may be hard to achieve with an expanding northern pike population that has proven to be capable of creating a high density population. Nonetheless, a walleye population of similar size to other naturally reproducing waters of northern Wisconsin is achievable based on the history of walleye in Patten Lake. Re-establishing a high density population (3-8 adults/acre) would go a long way in improving the fisheries of Florence County by providing a quality walleye fishing opportunity in an area that lacks good walleye populations.

I suggest changing the current no minimum length limit, 3 fish daily bag, to a 15-inch minimum length limit with a 5 fish daily bag limit. This change is one of the necessary steps to achieving management goals stated above.

Largemouth Bass

Currently Patten Lake boasts a low density largemouth bass population with an amazing size structure. Body condition analysis shows that the population is made up of "healthy" individuals. This high size structure and body condition offers a unique trophy largemouth bass fishing opportunity. The major management goal going forward should be to ensure that we do not loose the current trophy opportunity. Maintaining a population at the current level, between 1 and 2 adults per acre, should allow us to accomplish this goal.

The current 14-inch minimum size limit, daily bag of 5 fish, along with the added protection of the northern catch and release season to protect spawning bass has done a fine job for the largemouth bass population in Patten Lake. If we ever loose the protection of the northern bass zone a more restrictive regulation should be considered. Out of our current regulation packages available I believe the no minimum length limit, but fish from 14 to 18 inches can not be kept, and only 1 fish over 18 inches would be the best choice. This regulation should maintain growth rates while adding protection to larger fish maintaining a quality size structure. However, I do have some reservations about going with the slot because largemouth bass recruitment has not been low in the recent past (except 2011), which may not supply enough fish to reach the protected slot. Currently the only other regulation available that would limit the harvest of larger individuals is an 18-inch length limit, with a daily bag of one fish. I believe this regulation would likely increase the abundance of largemouth bass and negatively affect growth, size structure and body condition.

Smallmouth Bass

The smallmouth bass population in Patten Lake is very similar to the largemouth bass population. The low density of smallmouth bass has played a role in obtaining very good size structure and growth rates. However, the body condition of smallmouth bass is negatively correlated with body length, suggesting that conditions (most likely forage) are more limiting for larger adults. One possible reason for this trend is that shorter/younger bass are eating the same forage as longer/older bass, most likely crayfish, which seem to be of moderate abundance. If this is the case, and the prey size is not increasing or becoming more abundant for the larger fish, which must use more energy to forage, one would expect a negative relationship between body condition and length. Largemouth bass on the other hand have a much larger gap size, and the longer/older individuals are able to capitalize on larger bodied prey, bluegills and black bullheads, which may be why body condition does not change with length for largemouth bass. Smallmouth bass likely are not able to prey on larger bluegills and bullheads due to the shape of the prey. It will be interesting to see if body condition of smallmouth bass changes with the reduction of a prey species difficult to eat, black bullhead, and potentially increased abundance of other more edible pan fish species once the bullhead population is reduced.

The smallmouth bass population has increased in the recent past so special attention should be given to monitoring smallmouth bass abundance, as well as body condition, in response to bullhead removals.

The current 14-inch minimum length limit, daily bag of 5 fish, along with the added protection of the northern catch and release season to protect spawning bass has done a fine job for the smallmouth bass population in Patten Lake. If the northern catch and release zone is ever lost I would

recommend the same regulations that I recommended for largemouth bass, to maintain a low density population with good size structure. Hopefully by this time there is a new suite of regulations with a better option than the current 14 to 18-inch slot.

Panfish

In general panfish populations in Patten Lake are comprised of relatively young individuals with good growth rates and moderate to low size structure. Angler harvest is probably one of the major reasons for the lack of older/larger individuals. Some consideration should be given to decreasing the bag limit for panfish if size structure does not increase in the future. However, at the current state there is a fairly abundant bluegill population that has a high percentage of quality fish and no regulation changes are recommended at this time.

Black Bullheads

While it is unlikely that the abundance of black bullheads alone is the cause for the walleye population decline, the overabundance of black bullheads certainly is not helping the situation. I recommend continuing bullhead removals via fyke net during spring and summer to reduce the bullhead population to a catch rate of less than 10 bullheads/net-night during both spring and summer surveys. A relative abundance of that size is still higher than historic levels, but significantly less than present day. Monitoring of game and panfish species response to bullhead removals should be a priority for the Florence fish management team, in an effort to better understand the relationship between black bullheads and other game species.

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Appendix A – Length Frequencies

Table 1. Length frequency of northern pike captured during netting and electrofishing surveys of Patten Lake, Florence County 2011 (Unmarked fish only).

Inch Group	Spring Netting	Electro Fishing	Summer Netting
8			
9	1	1	
10		1	2
11	2	2	7
12	1	3	11
13	2	2	16
14	2	2	6
15	2		2
16	2		2
17	4	1	4
18	2		1
19	7	4	3
20	7	2	3
21	15	5	5
22	20	4	7
23	20	2	4
24	8	4	4
25	4	1	1
26	4	1	3
27	7	1	2
28	2		
29			1
30	2		1
31	1		
32			
33	1		
Totals	116	36	85

Table 2. Length frequency of largemouth bass captured during netting and electrofishing surveys of Patten Lake, Florence County 2011 (Unmarked fish only).

Inch Group	Spring Netting	Shock 4/28/11	Shock 5/18/11	Shock 5/23/11	Shock 5/26/11	Shock 6/2/11	Total
< 8.0	1					1	2
8	2			2	1	2	7
9			1	2	4	3	10
10						1	1
11		1	2		2	1	6
12		2	4	1			7
13	1	2	3	2	3	1	12
14	2	4	2	3	3	5	19
15	2	1	3	1	1	2	10
16	4	2		2	2	2	12
17					1	1	2
18	1		2	4	4	5	16
19				1	2	1	4
20	1	2				1	4
Totals	14	14	17	18	23	26	112

Table 3. Length frequency of walleye captured during netting and electrofishing surveys of Patten Lake, Florence County 2011 (Unmarked fish only).

Inch Group	Spring Netting	Spring Shocking	Fall Shocking
< 8.0			60
8			2
9			21
10			39
11	1		12
12	5	1	1
13	5	3	1
14	5	4	3
15	15	8	1
16	10	7	1
17	6	1	
18	14	3	
19	7	2	
20	7	2	
21	7		2
22	1	1	
23	5	1	
24	5		
25	2		
26	3		
27	5		
28	6		
29	1		
30			
Totals	110	33	143

Table 4. Length frequency of smallmouth bass captured during netting and electrofishing surveys of Patten Lake, Florence County 2011 (Unmarked fish only).

Inch Group	Spring Netting	Shock 4/28/11	Shock 5/18/11	Shock 5/23/11	Shock 5/26/11	Shock 6/2/11	Total
< 8.0	1					1	2
8				1			1
9			1	1		5	7
10			4	2	3	5	14
11			1	1		3	5
12			2	4	1		7
13			1	1	1	1	4
14			2	1		4	7
15			3		1	3	7
16	1			2	4	4	11
17	2		1	3		4	10
18			1	6	3	1	11
19				2	1	4	7
20				1	1	2	4
Totals	4	0	16	25	15	37	97

Table 5. Length frequency of subsamples of panfish measured during summer fyke netting of Patten Lake, Florence County 2011.

Inch Group	Bluegill	Pumpkinseed	Yellow Perch	Black Crappie	Rock Bass	Black Bullhead
< 3.0						
3	12	7				
4	39	28			3	
5	100	38	1		11	
6	88	13	9	1	13	
7	60		7		15	7
8	17		2	1	6	12
9			1	3		33
10						5
11				1		
12				2		
13						
Sample Size	316	86	20	8	48	57

Appendix B – Average Length at Age

Table 1. Mean length (inches) at age for northern pike captured during a spring fyke net survey of Patten Lake during 2011, compared to 2004 and the Northern Region of WI averages (2011: Male: N=53, Female: N=21).

Age	Male	Female	Combined	2004	NOR Ave
1				10.7	10.6
2	15.3		15.3	16.6	13.1
3	18.6	18.3	18.5	19.0	16.3
4	21.2	23.0	21.6	21.1	19.5
5	22.5	24.4	23.4	22.1	22.0
6	23.7	27.2	24.6	23.5	24.5
7	24.5	28.8	26.6	24.6	27.7
8	26.1	33.7	28.6	25.3	30.3
9	27.3		27.3		31.5
10					

Table 2. Mean length (inches) at age for walleye captured during a spring fyke net survey of Patten Lake during 2011, compared to 2004 and Northern Region of WI averages (2011: Male: N=69, Female: N=36, Unknown: N=12).

Age	Male	Female	Combined	2004	1981	NOR Ave
1				7.3		6.4
2	11.2		11.2	11.1	12.6	9.5
3	12.9		12.9	13.2	15.4	11.7
4	14.9		14.8	14.3	15.3	13.8
5	15.8		15.8	17.3	17.9	15.8
6	16.8	19.3	17.2	18.1		17.5
7	18.3	20.3	19.1	18.8	21.3	19.1
8	19.0	23.1	21.3	19.5		20.5
9	19.7	24.9	22.5	20.1		21.6
10	22.2	24.1	21.7	20.2		22.7
11		27.1	25.8	22.3		23.7
12	21.1	28.0	26.6	22.2		24.4
13		28.3	28.3	25.7		25.2
14						

*Walleye introduced to Patten Lake in 1974.

Table 3. Mean length (inches) at age for largemouth bass captured during spring surveys of Patten Lake during 2011, compared to 1981 and Northern Region of WI averages (2011: N=85).

Age	2011	1981	NOR Ave
1			3.8
2	5.8	7.1	6.6
3	8.9	9.3	9.0
4	9.5	11.1	10.8
5	12.0	13.1	12.7
6	13.7	14.2	14.3
7	15.4	15.2	15.7
8	17.2	18.4	17.0
9	18.9		17.9
10	20.0		18.5
11	20.7		19.5
12			

Table 4. Mean length (inches) at age for smallmouth bass captured during spring surveys of Patten Lake during 2011, compared to Northern Region of WI averages (2011: N=86).

Age	2011	NOR Ave
1		3.4
2	8.6	7.2
3	10.2	9.1
4	12.1	11.2
5	15.0	13.6
6	16.5	15.5
7	18.7	16.0
8	18.3	17.8
9	19.7	18.6
10	20.4	19.9
11		

Table 5. Mean length (inches) at age for bluegill captured during a summer fyke net survey of Patten Lake during 2011, compared to Northern Region of WI averages (2011: N=57).

Age	2011	NOR Ave
1	3.8	2.9
2	4.1	3.6
3	5.0	4.7
4	5.9	5.6
5	6.7	6.4
6	7.3	7
7	7.9	7.6
8	8.2	7.9
9	8.6	8.5
10		

Table 6. Mean length (inches) at age for pumpkinseed captured during a summer fyke net survey of Patten Lake during 2011, compared to State of WI averages (2011: N=36).

Age	2011	State Ave
1		3.2
2	3.8	3.9
3	4.7	4.7
4	5.7	5.4
5	6.3	6
6	6.6	6.5
7		

Table 7. Mean length (inches) at age for rock bass captured during a summer fyke net survey of Patten Lake during 2011, compared to State of WI averages (2011: N=30).

Age	2011	State Ave.
1		4.1
2	4.4	4.0
3	5.3	5.3
4	6.2	6.3
5	7.3	7.2
6	8.1	8.0
7	8.2	8.6
8		

Table 8. Mean length (inches) at age for yellow perch captured during fyke net surveys of Patten Lake during 2011, compared to Northern Region of WI averages (2011: N=39).

Age	2011	NOR Ave.
1		3.5
2		4.6
3	6.0	6
4	6.7	6.7
5	7.8	7.5
6	9.1	8.3
7		

Table 9. Mean length (inches) at age for black crappie captured during fyke net surveys of Patten Lake during 2011, compared to Northern Region of WI averages (2011: N=21).

Age	2011	NOR Ave.
1		3.9
2		5.8
3	6.3	7.1
4		8.5
5	9.2	9.1
6	9.9	9.9
7	11.0	10.6
8	11.9	11.6
9	12.1	11.8
10	12.6	
11		13.3
12	13.0	

Appendix C – Catch per Unit Effort (Netting)

Table 1. Gamefish catch per net-night during spring fyke netting of Patten Lake 2011, compared to catch per net-night during previous spring surveys, 1981-2004.

Species	Mean Catch	04' Mean Catch	93' Mean Catch	81' Mean Catch
Brook Trout	0.15	---	0.07	0.2
Largemouth Bass	0.58	0.08	0.20	4.6
Northern Pike	5.23	8.21	Not Present	Not Present
Smallmouth Bass	0.15	---	---	---
Walleye	5.42	15.17	17.97	10.5

Table 2. Gamefish catch per net-night during summer fyke netting of Patten Lake 2011, compared to catch per net-night during the 1967 summer survey.

Species	2011 Mean Catch	1967 Mean Catch
Brook Trout	---	---
Largemouth Bass	0.37	0.50
Northern Pike	0.55	Not Present
Smallmouth Bass	0.29	---
Walleye	0.28	Not Present

Table 3. Panfish catch per net-night during summer fyke netting of Patten Lake 2011, compared to catch per net-night during the 1967 summer survey.

Species	Mean Catch	67' Mean Catch
Black Bullhead	*19.85	0.92
Black Crappie	0.42	---
Bluegill	50.98	101.67
Hybrid BGxSeed	0.02	
Pumpkinseed	2.1	6.08
Rock Bass	2.51	8.67
Yellow Perch	1.08	1.42

*Black bullhead were removed through 2011 netting surveys reducing their catch rate.

Table 4. Panfish catch per net-night during spring fyke netting of Patten Lake 2011, compared to catch per net-night during previous spring surveys, 1981-2004.

Species	Mean Catch	04' Mean Catch	93' Mean Catch	81' Mean Catch
Black Bullhead	*56.69	5.96	**135.5	---
Black Crappie	0.27	0.04	---	---
Bluegill	14.46	0.21	2.8	97.5
Hybrid BG x Seed	0	---	---	---
Pumpkinseed	0.54	---	0.1	0.1
Rock Bass	0.31	0.13	5.4	4.3
Yellow Perch	3.38	0.21	3.3	7.6

*All black bullhead caught were removed, reducing their catch rate.

**Bullhead were only counted during two net lifts

Table 5. Recruitment of walleye, indexed using catch per mile of age-0 walleyes during fall electrofishing surveys of Patten Lake, Florence County 1991-2011

	1991	1992	1993	1998	2000	2001	2002	2004	2005	2007	2008	2010	2011
Age 0/mi.	35.5	12.0	8.1*	16.5	5.5	116.2	105.9	114.0*	7.9	1.5	4.1	20.0	15.8

*Average of two surveys

Table 6. Summary of fish species, number and size range captured during the survey of Patten Lake, Florence County, 2011.

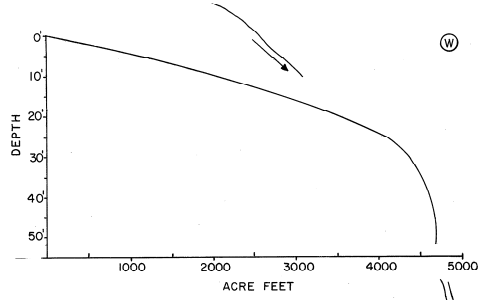
		Spring Netting			Spring Electro Fishing			Summer Netting			Fall Electro Fishing		
Common Name	Scientific Name	Catch	Min. Size	Max. Size	Catch	Min. Size	Max. Size	Catch	Min. Size	Max. Size	Catch	Min. Size	Max. Size
Black Bullhead	*Ictalurus melas*	1474	---	---	---	---	---	4525	7.3	10.4	---	---	---
Black Crappie	*Pomoxis nigromaculatus*	7	9.6	12.9	---	---	---	36	6.3	13.0	---	---	---
Bluegill	*Lepomis macrochirus*	376	---	---	---	---	---	4384	3.6	8.8	---	---	---
Brook Trout	*Salvelinus fontinalis*	4	7.0	10.9	---	---	---	0	---	---	---	---	---
Creek Chub	*Semotilus atromaculatus*	1	---	---	---	---	---	0	---	---	---	---	---
Golden Shiner	*Notemigonus crysoleucas*	2	---	---	---	---	---	3	---	---	---	---	---
Largemouth Bass	*Micropterus salmoides*	15	5.9	20.6	110	5.7	20.8	32	---	---	29	1.5	7.9
Northern Pike	*Esox lucius*	136	9.0	33.7	41	9.0	27.4	92	10.5	30.9	2	8.5	13.4
Pumpkinseed	*Lepomis gibbosus*	14	---	---	---	---	---	181	3.4	6.6	---	---	---
Rock Bass	*Ambloplites rupestris*	8	---	---	---	---	---	216	4.4	8.4	---	---	---
Smallmouth Bass	*Micropterus dolomieui*	4	5.6	17.8	107	7.9	20.9	25	---	---	4	5.0	6.4
Walleye	*Sander vitreus*	141	11.2	29.9	76	5.0	28.9	24	---	---	143	4.4	21.9
White Sucker	*Catostomus commersoni*	147	---	---	---	---	---	7	---	---	---	---	---
Yellow Perch	*Perca flavescens*	88	5.7	9.1	---	---	---	93	5.8	9.4	---	---	---

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

LAKE SURVEY MAP

PATTEN LAKE — FLORENCE COUNTY

SEC. 13, 18, 19, 24 T. 39 N. R. 16, 17 E.



Department of Natural Resources
B.M. 'X' Square cut in S. corner of concrete foundation of a turquoise outhouse. 138' W. of public boat landing, on W. side of lake.
Assumed elevation 100.00'
Water level 93.76'

R-16-E / R-17-E

N

State Land Commission

County Land

B.M. X

Price Lake
106 Acres
6 Ft Deep

Sec. 13 / Sec. 24

Sec. 18 / Sec. 19

Florence 12 miles

EQUIPMENT RECORDING SONAR MAPPED JULY (MONTH) 1967 (YEAR)

TOPOGRAPHIC SYMBOLS

- (B) Brush
- (PW) Partially wooded
- (W) Wooded
- (C) Cleared
- (P) Pastured
- (A) Agricultural
- B.M. Bench Mark
- ■ Dwelling
- ▣ Resort
- ⊡ Camp
- Steep slope
- Indefinite shoreline
- Marsh
- Spring
- Intermittent stream
- Permanent inlet
- Permanent outlet
- Dam
- D.N.R. State owned land

LAKE BOTTOM SYMBOLS

- P. Peat
- Mk. Muck
- C. Clay
- M. Marl
- Sd. Sand
- Si. Silt
- Gr. Gravel
- R. Rubble
- Br. Bedrock
- B Boulders
- Stumps & Snags
- Rock danger to navigation
- T Submergent vegetation
- ⊥ Emergent vegetation
- Floating vegetation
- Brush shelters

500' 0' 500' 1000' 1500' 2000'
SCALE

◇ Access ◇ Access with Parking ◆ Boat Livery

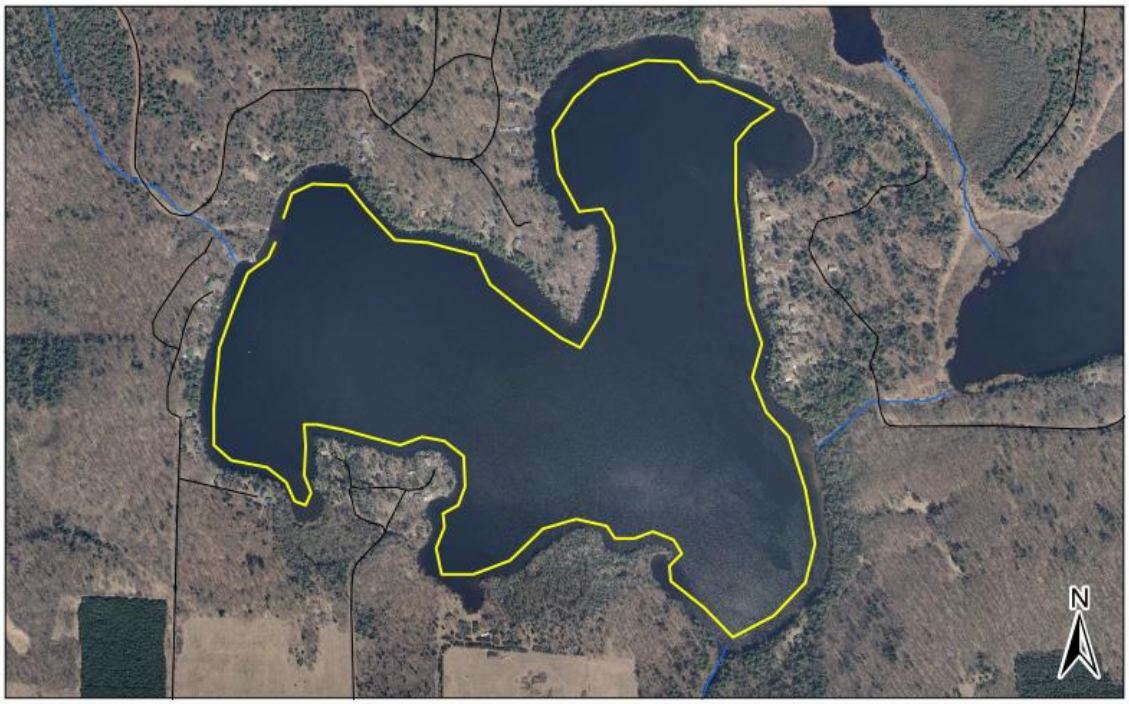
Drawn by: C. Holt
Field work by: P. Michelson

SPECIES OF FISH	Abundant	Common	Present
Muskie			
N. Pike			
Walleye			
L.M.Boss			X
S.M.Bass			
Panfish		X	
Trout			

WATER AREA 255.1 ACRES
UNDER 3 FT. 13.2 %
OVER 20 FT. 47.7 %
MAX. DEPTH 52 FEET.
TOTAL ALK. 72 P.P.M.
VOLUME 4675.6 ACRE FT.
SHORELINE 3.9 MILES

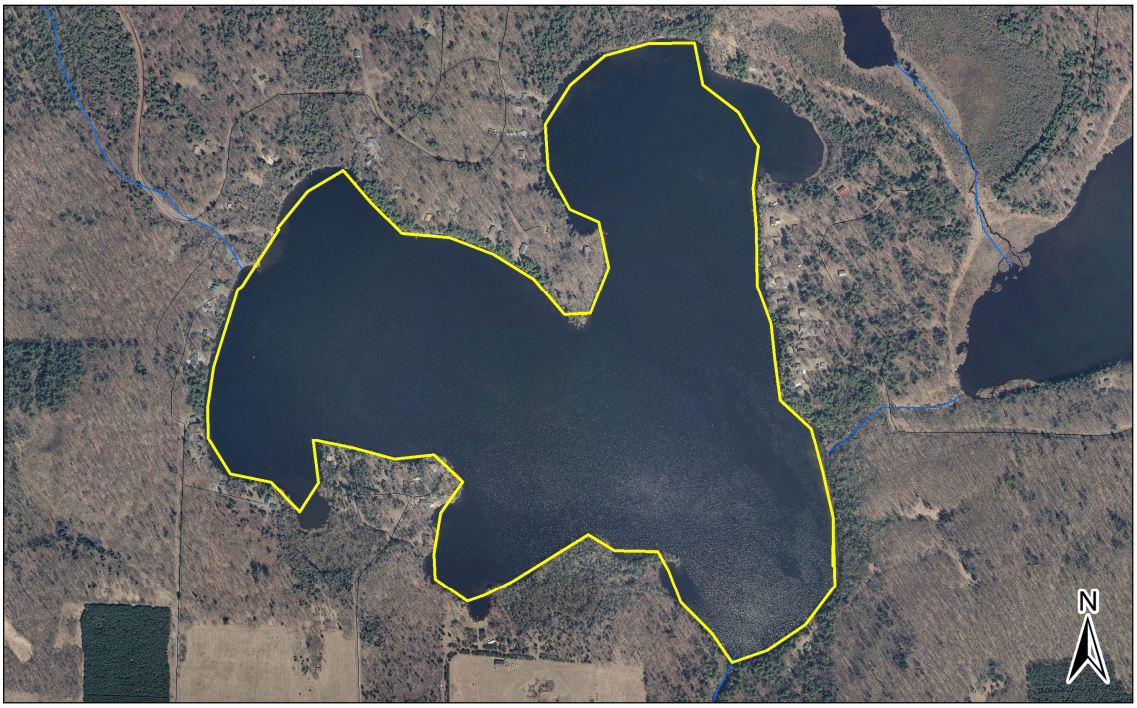
Patten Lake
Spring Net Locations
4/25-4/28 2011
26 Net-Nights

Mapped By: Jake Walcisak
January 9th, 2012



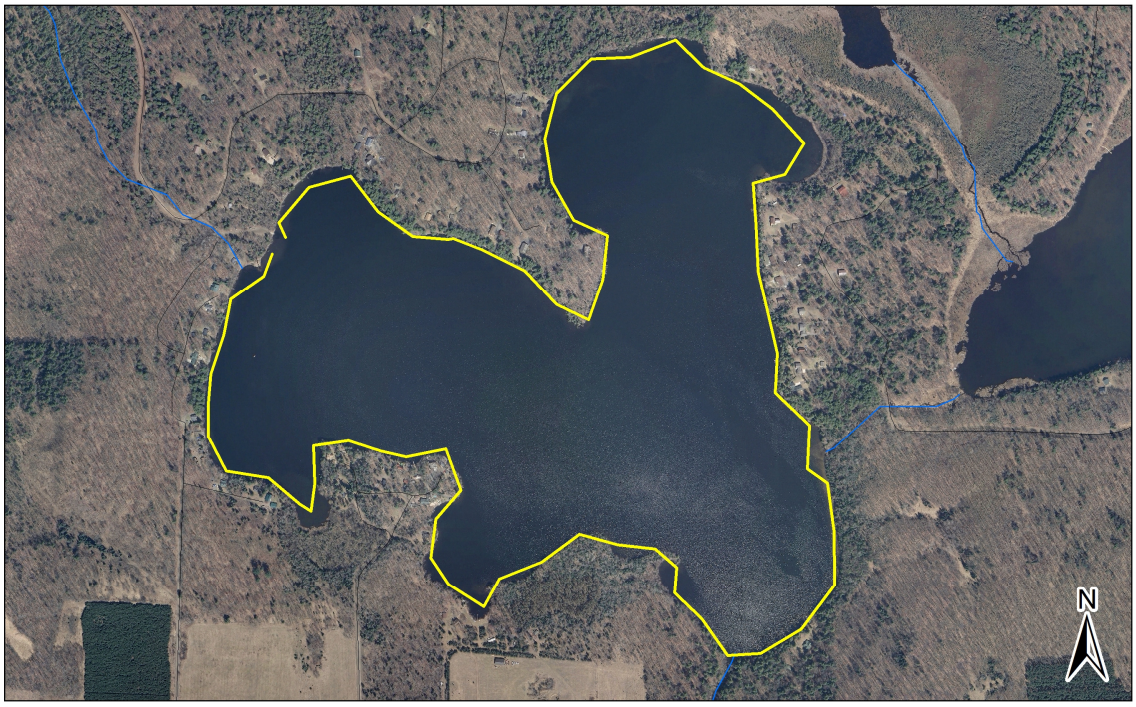
Patten Lake
Walleye Recapture Survey
4/28/2011
4.1 Miles

Mapped By: Jake Walcisak
January 9th, 2012



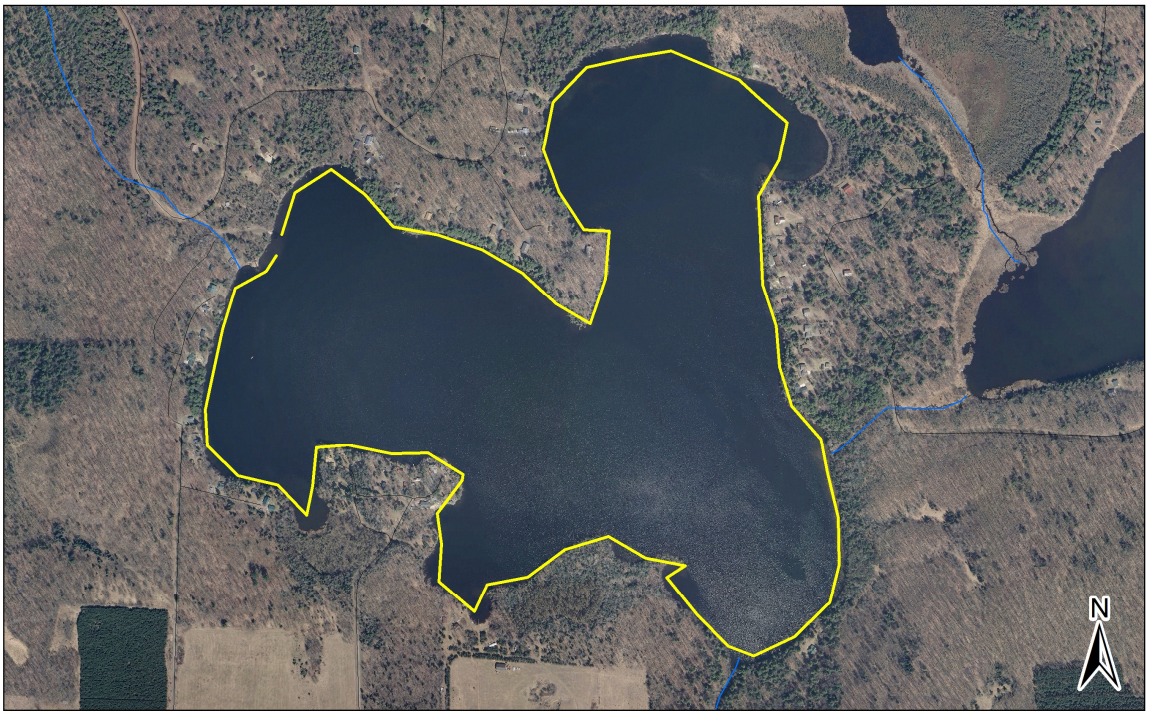
Patten Lake
Bass Electrofishing Survey #1
5/18/2011
4.4 Miles

Mapped By: Jake Walcisak
January 9th, 2012



Patten Lake
Bass Electrofishing Survey #2
5/24/2011
4.48 Miles

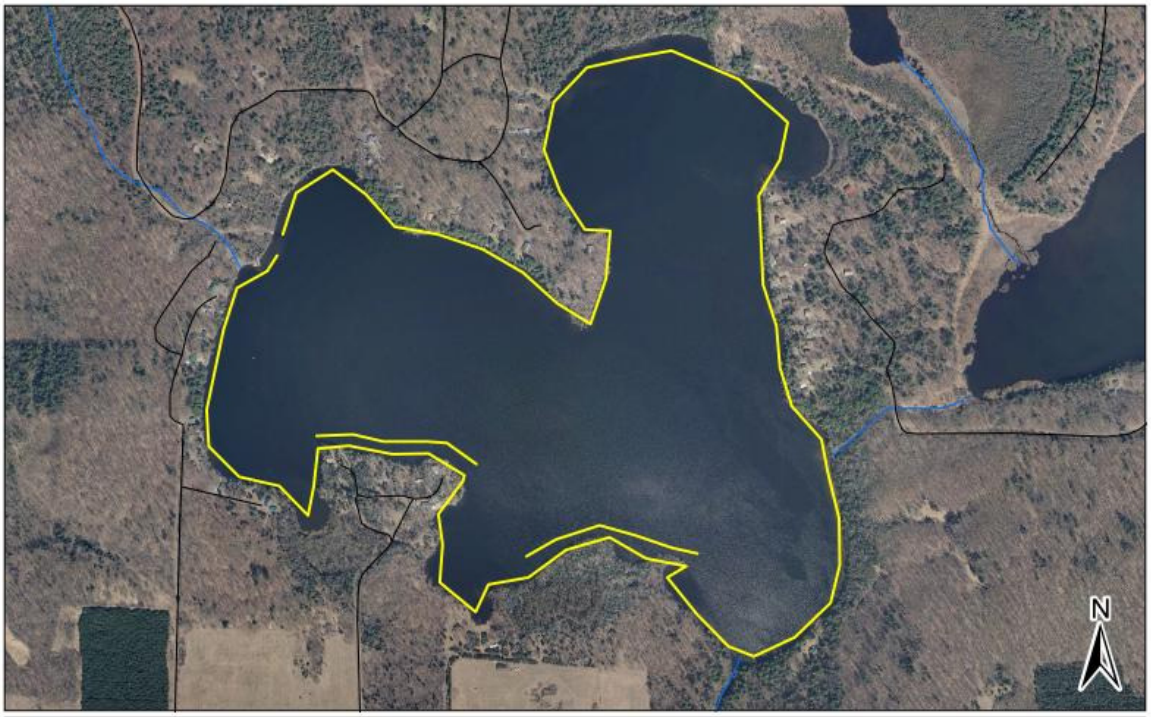
Mapped By: Jake Walcisak
January 9th, 2012



Patten Lake
Bass Electrofishing Survey #3
6/1/2011
4.4 Miles

Florence County Forestry & Parks Department

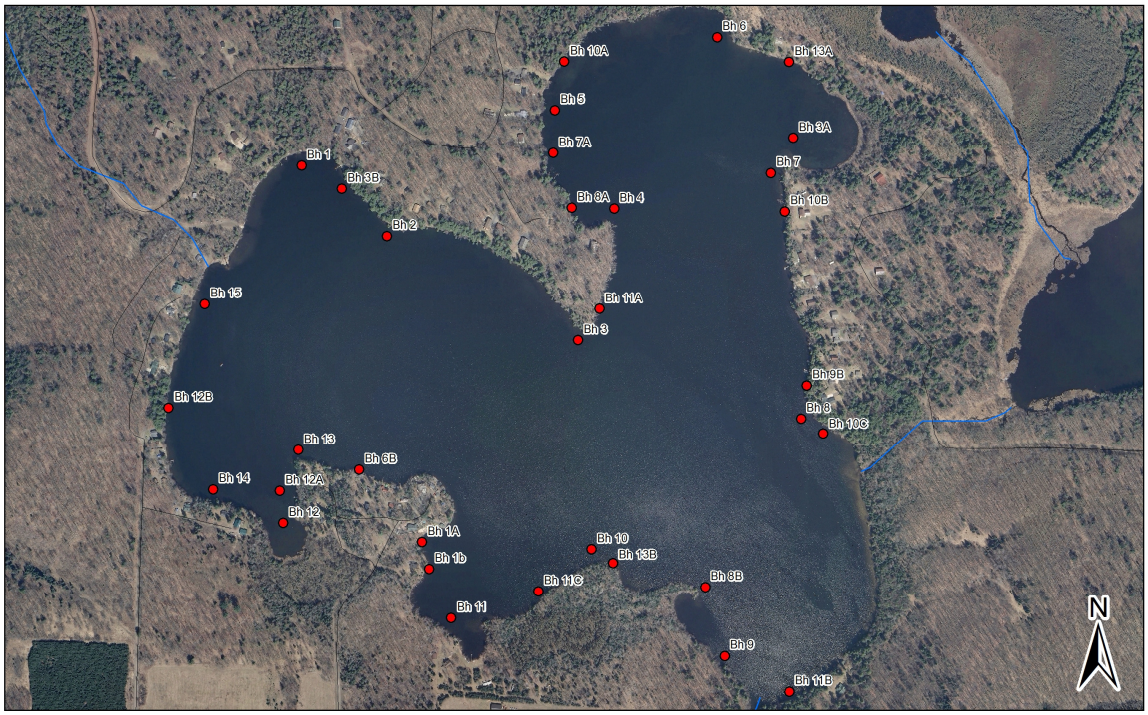
Mapped By: Jake Walcisak
January 9th, 2012



Patten Lake
Bass Recapture Survey
6/2/2011
4.49 Miles

Florence County Forestry & Parks Department

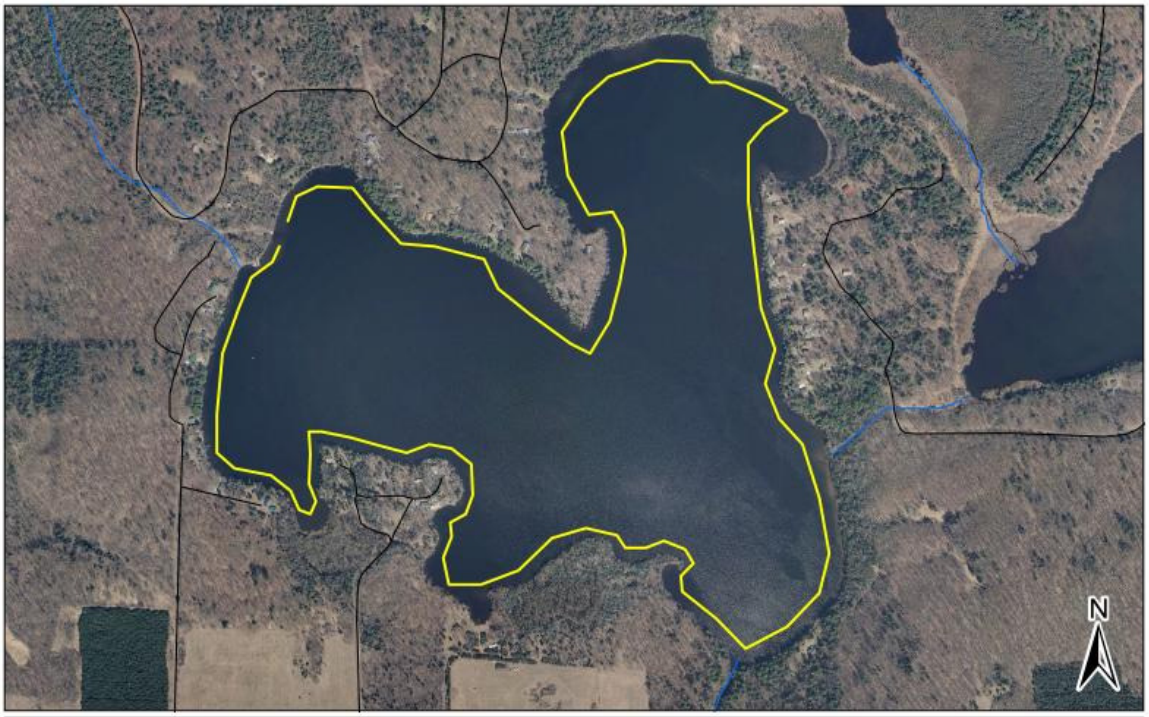
Mapped By: Jake Walcisak
January 9th, 2012



Patten Lake
Bullhead Removal and Panfish Survey

6/15-7/1 2011
228 Net-Nights

Mapped By: Jake Walcisak
January 9th, 2012



Patten Lake
Fall Recruitment Survey

10/1/2011
3.9 Miles

Mapped By: Jake Walcisak
January 9th, 2012